Investigation: Two-way tables

- Complete 1 - 5 on page 1

Check together before doing bottom half.

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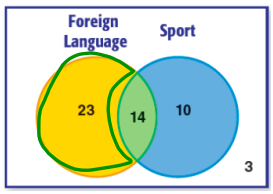

1. How many students are taking a foreign language?
2. How many students play a sport?
3. How many students do both?
4. How many students do not play a sport and do not take a foreign language?
5. How many students play a sport but do not take a foreign language?

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A *two-way table* is similar to a Venn diagram. A two-way table shows data that pertain to two different categories, which requires us to only use categorical variables. The data from one sample group is shown as it relates to two different categories. One variable is represented by rows, and the other is represented by columns.

Use the data from above to fill in the two-way table.

	Play a Sport	Do Not Play a Sport	Total
Take a Foreign Language	14	23	37
Do Not Take a Foreign Language	10	3	13
Total	24	26	50

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2 Felipe surveyed students at his school. He found that 78 students own a cell phone and 57 of those students own an MP3 player. There are 13 students that do not own a cell phone, but own an MP3 player. Nine students do not own either device.

Construct a two-way frequency table summarizing the data.

	MP3 Player	No MP3 Player	Total
Cell Phone	57	21	78
No Cell Phone	13	9	22
Total	70	30	100

marginal frequencies

joint distribution

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Marginal distributions are the totals of each individual category. These are located in the margins of the table. Use your table above to fill in the following:

70 students have MP3 players. 30 students do not have MP3 players.

78 students have cell phones. 22 students do not have cell phones.

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Joint distributions are the values that "join" the two variables together. Use your table to fill in the following:

57 students have cell phones and MP3 players

21 students have cell phones, but not a MP3 players

13 students have an MP3 player, but not a cell phone

9 students have neither a cell phone nor an MP3 player

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On a page that you will do you homework, create the following table

GENDER	AGE GROUP: 3-5 years old	6-8 years old	9-11 years old	12-14 years old	15-17 years old	TOTAL
Male	4	3	3	5	5	20
Female	1	4	3	4	3	15
Total	5	7	6	9	8	35

Jan 7-7:37 AM

Back to class examples...

Jan 7-7:39 AM

Politics & Gender. Political scientist collected the following data on 2,681 registered voters.

	Democrat	Independent	Republican	Marginal frequency
Male	356	460	369	1185
Female	567	534	395	1496
Marginal frequency	923	994	764	2681

Find the Marginal frequencies

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1) What percent of the sampled people are female?

1) % of female? $\frac{1496}{2681} \approx 55\%$

2) What percent of the sampled people are democrat?

2) % democrat? $\frac{923}{2681} \approx 34\%$

*Find probabilities in a table is the same as finding the percentages!

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Using marginal frequencies to calculate probabilities.

Assume we choose 1 person at random from the voters. Find each probability.

1) P(male) $= \frac{1185}{2681}$

2) P(republican) $= \frac{764}{2681}$

3) P(female) $= \frac{1496}{2681}$

4) P(independent) $= \frac{994}{2681}$

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Back to OR's...

Find each probability.

1) P(male or independent)

$P(\text{male}) + P(\text{ind}) - P(\text{male and ind})$

$\frac{1185}{2681} + \frac{994}{2681} - \frac{460}{2681} = \frac{1719}{2681}$

2) P(female or democrat)

$P(\text{female}) + P(\text{dem}) - P(\text{fem and dem})$

$\frac{1496}{2681} + \frac{923}{2681} - \frac{567}{2681} = \frac{1852}{2681}$

3) P(male or republican)

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Using joint frequencies to calculate probabilities. (Joint frequencies are the "inside" cells)

1) P(male and democrat) $= \frac{356}{2681}$

2) P(female and republican) $= \frac{395}{2681}$

3) P(female ∩ republican)

4) P(independent ∩ male)

5) What percent of people in the sample are independent and male?

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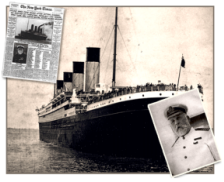
The Unsinkable Ship

On April 14, 1912, while en route to New York City, the "unsinkable" ship *The Titanic* struck and iceberg and within 3 hours was resting on the floor of the Atlantic Ocean. This disaster resulted in the loss of over 1,500 lives as lifeboats were scarce and the waters where the crash occurred were -2°C. (*Source:* www.titanicfacts.net)



The following table describes in part the passengers and crew on board by sex and survival status.

		Gender		
		Male	Female	TOTAL
Survived	Yes			711
	No			
	Total		470	2201

(*Source: Journal of Statistics Education, 3*(3), 1995)

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		Gender		
		Male	Female	TOTAL
Survived	Yes	367	344	711
	No	1364	126	1490
	Total	1731	470	2201

(*Source: Journal of Statistics Education, 3*(3), 1995)

711 .516

470 .268

2201 .67

For all calculations round to the nearest whole number
Use these facts to fill in the table completely with frequencies:

- ☐ Of the survivors of this tragic event, 51.6% were males.
- ☐ 26.8% of females died in this tragic accident.
- ☐ 67.7% of passengers on board did not survive this accident.

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Use the completed table to answer the following probabilities.

1) P(female) $= \frac{470}{2201}$

2) P(died) $= \frac{1490}{2201}$

3) P(female ∩ died) $= \frac{126}{2201}$

4) P(female or U died)

$P(Fem) + P(died) - P(F \cap Died)$

$\frac{470}{2201} + \frac{1490}{2201} - \frac{126}{2201} = \frac{1834}{2201}$

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Conditional probabilities

- Looking at just one of the inside rows or columns.

1) What is the probability that the person was male, given that the person died?

$P(male \mid died) = \frac{1364}{1490}$ ← "given that"

2) What is the probability that the person died, given that the person was male? $\frac{1364}{1731}$

$P(died \mid male)$ ← "given that"

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1) Below are the counts (in thousands) of earned degrees in the United States in a recent year, classified by level and by the sex of the degree recipient. **One person is selected at random**, find the following probabilities.

	Bachelor's	Master's	Professional	Doctorate	Total
Female	616	194	30	16	856
Male	529	171	44	26	770
Total	1145	365	74	42	1626

a. Probability of a female. $P(Female) = \frac{856}{1626}$

b. Probability of having a master's degree. $P(Masters) = \frac{365}{1626}$

c. Probability of a female and a doctorate. $P(Fem \cap Doc) = \frac{16}{1626}$

d. Probability of a male and bachelor's. $P(male \cap Bach) = \frac{529}{1626}$

e. Probability of master's or professional. $P(mast \cup Prof)$ $P(mast) + P(Prof) - P(mast \cap Prof)$

f. Probability of female or bachelor's.

g. Probability of male or female.

h. Probability of bachelor's or male.

i. Probability of female given she has a doctorate. $P(Female \mid Doc)$

j. Probability of master's given he is male.

k. Are the events "choose a male" or "choose a doctorate degree recipient" exclusive or inclusive

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