

### 4.3 Rules of Probability

#### GOALS:

1. Use Venn Diagrams to understand how characteristics of populations relate to each other, to assign numbers to a sample space, and to obtain probabilities.
2. Find probability using the General Addition Rule.
3. Find probability using the Complementation Rule.

Study Ch. 4.3 # 78(67), 87(~69), 89,  
90(73), 95, 99(~81), 100

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### 4.3 Rules of Probability

Given: of US adults  
51.8% are female (F),  
10.2% divorced (D),  
6.0% are divorced females

Find: a)  $P(F)$ ,  $P(D)$ ,  $P(F \& D)$   
b)  $P(F \text{ or } D)$ , interpret as %  
c)  $P(\text{male})$

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## 4.3 Rules of Probability

Given: of US adults  
 51.8% are female (F),  
 10.2% divorced (D),  
 6.0% are divorced females

$$0 \leq p \leq 1$$

Find: a)  $P(F)$ ,  $P(D)$ ,  $P(F \& D)$

Solution: use percentages given

$$P(F) = \underline{\hspace{2cm}}$$

$$P(D) = \underline{\hspace{2cm}}$$

$$P(F \& D) = \underline{\hspace{2cm}}$$

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## 4.3 Rules of Probability

Given: of US adults  
 51.8% are female (F),  
 10.2% divorced (D),  
 6.0% are divorced females

Find: a)  $P(F)$ ,  $P(D)$ ,  $P(F \& D)$

Solution: use percentages given

$$P(F) = \underline{0.518}$$

$$P(D) = \underline{0.102}$$

$$P(F \& D) = \underline{0.060}$$

$$0 \leq p \leq 1$$

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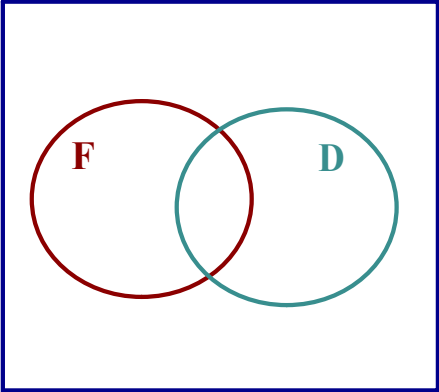
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4.3 Rules of Probability 1000

p. 182 # 66 Given: 51.8% of US adults are female (F),  
 10.2% divorced (D),  
 6.0% are divorced females

Find: b)  $P(F \text{ or } D)$ , interpret as %

1000



Let size of sample space = 1000  
 (percent is hundredths, we have tenths of percent, or thousandths)

How can we start entering numbers?

Want total to be 1000.

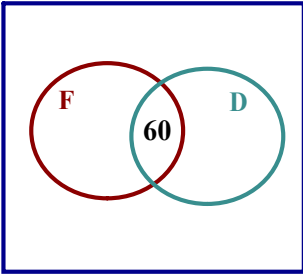
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4.3 Rules of Probability

	%	decimal	x 1000
p. 182 # 66 Given: 51.8% of US adults are female (F),		0.518	518
10.2% divorced (D),		0.102	102
6.0% are divorced females		0.060	60

Find: b)  $P(F \text{ or } D)$ , interpret as %



Let size of sample space = 1000  
 (percent is hundredths, we have tenths of percent)

Start with the 60 divorced females.

Next?

518 females  
 102 divorced females  
 60 females NOT divorced

102 divorced  
 60 divorced NOT female  
 42 females NOT divorced

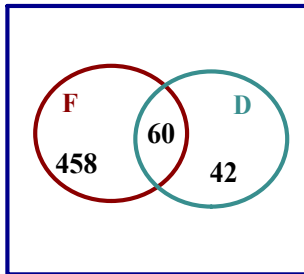
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4.3 Rules of Probability

	<b>%</b>	<b>decimal</b>	<b>x 1000</b>
p. 182 # 66	Given: 51.8% of US adults are female (F),	0.518	518
	10.2% divorced (D),	0.102	102
	6.0% are divorced females	0.060	60

Find: b)  $P(F \text{ or } D)$ , interpret as %



Let size of sample space = 1000  
(percent is hundredths, we have tenths of percent)

Start with the 60 divorced females.

Next?

518 females  
- 60 divorced females  
458 females NOT divorced

102 divorced  
- 60 divorced females  
42 divorced NOT female

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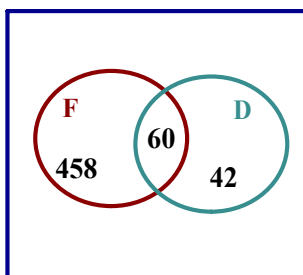
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4.3 Rules of Probability

p. 182 # 66 Given: 51.8% of US adults are female (F),  
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Find: b)  $P(F \text{ or } D)$ , interpret as %



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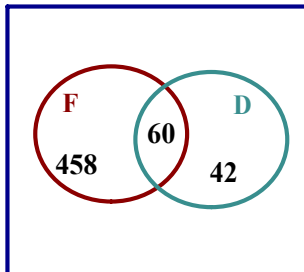
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4.3 Rules of Probability

p. 182 # 66 Given: 51.8% of US adults are female (F),  
10.2% divorced (D),  
6.0% are divorced females

Find: b)  $P(F \text{ or } D)$ , interpret as %



$$P(F \text{ or } D) = \frac{458+60+42}{1000} = \frac{560}{1000} = 0.560$$

$$P(F \text{ or } D) = P(F) + P(D) - P(F \& D)$$

$$= 0.518 + 0.102 - 0.060$$

$$= 0.620 - 0.060 = 0.560$$

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4.3 Rules of Probability

**General Addition Rule:**

$$P(A \text{ or } B) = P(A) + P(B) - P(A \& B)$$

Need to subtract  $P(A \& B)$  because it was added twice,  
once in  $P(A)$  and once in  $P(B)$

Given: of US adults

51.8% are female (F),  $p(F) = 0.518$   
10.2% divorced (D),  $p(D) = 0.102$  sum = 0.620  
6.0% are divorced females but 60 counted twice

need to subtract  $p(F \& D) = 0.060$  so it is only counted once

$$P(F \text{ or } D) = P(F) + P(D) - P(F \& D)$$

$$= 0.518 + 0.102 - 0.060$$

$$= 0.620 - 0.060 = 0.560$$



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4.3 Rules of Probability

General Addition Rule:

$$P(A \text{ or } B) = P(A) + P(B) - P(A \& B)$$

Special Case

If events **A** and **B** are mutually exclusive,  $P(A \& B) = 0$   
and

$$P(A \text{ or } B) = P(A) + P(B)$$

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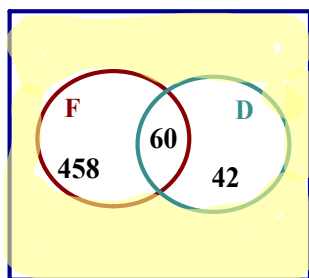
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4.3 Rules of Probability

Given: 51.8% of US adults are female (F),  
10.2% divorced (D),  
6.0% are divorced females

How many are **not female and not divorced?**  
(outside the circles)

Let size of sample space = 1000  
(percent is hundredths, we have tenths of percent)



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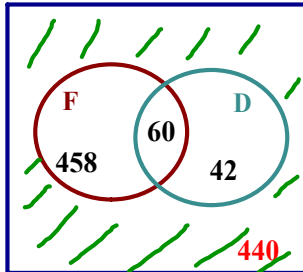
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4.3 Rules of Probability

p. 182 # 66 Given: 51.8% of US adults are female (F),  
 10.2% divorced (D),  
 6.0% are divorced females

**How many are *not* female and *not* divorced?**

(outside the circles)



Let size of sample space = 1000  
 (percent is hundredths, we have tenths of percent)

How many not female and not divorced? (outside the circles)

$$1000 - (458 + 60 + 42) = 1000 - 560 = 440$$

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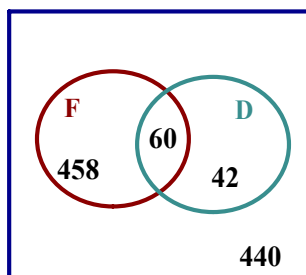
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4.3 Rules of Probability

p. 182 # 66  
 Given: 51.8% of US adults are female (F),  
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**Find: c) P(male)**



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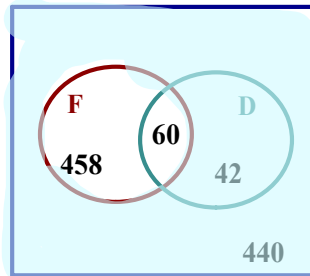
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## 4.3 Rules of Probability

p. 182 # 66

Given: 51.8% of US adults are female (F),  
 10.2% divorced (D),  
 6.0% are divorced females

Find: c) P(male)



In sample space of 1000, with 518 females, how many males? 482

Therefore,  $P(M) = 0.482$

How can you check this?  
 (Compare to % female)

$$P(\text{male}) = \frac{440 + 42}{1000} = \frac{482}{1000} = 0.482$$

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## 4.3 Rules of Probability

**Complementation Rule:  $P(E) = 1 - P(\text{not } E)$**

$$\begin{aligned}
 P(M) &= 1 - P(\text{not } M) \\
 &= 1 - P(F) \\
 &= 1 - 0.518 \\
 &= 0.482
 \end{aligned}$$

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