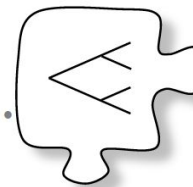# 3.1.4 What are the chances of both events?

Unions, Intersections, and Complements

3-35 Election Day

a) What is the probability that a randomly selected vote supports both the Democratic candidate for Governor and the Democratic candidate for Attorney General? Show your work.

b) What is the *sample space* for all of the possible outcomes in voter support of the candidates for Governor and Attorney General?

c) A set of outcomes (a subset of the sample space) is called an *event*. Which outcomes from the sample space are in the event, supporting "Democratic Governor?"

Which outcomes are in the event, supporting "Democratic Attorney General?"

d) The *intersection* of two events A and B is the event consisting of all outcomes that are both in A and B. Complete the area model for this situation.

Governor

Attorney General	R (.40)	D (.53)	Other (.07)
R (.61)			
D (.37)			
Other (.02)			

What outcomes are in the *intersection* of the events "Democratic Governor" and "Democratic Attorney General?"

How is this shown in your area model?

e) Highlight the event, "Democratic Governor" and then highlight the event, "Democratic Attorney General." What do you notice about the intersection of the two events?

1

3-36 Union

The ***union*** of two events A and B is the event consisting of all outcomes that are either in A or in B or in both events.

a) Is Darren correct? Why or why not?

b) What outcomes from the sample are the *union* of the events"Democratic Governor" and "Democratic Attorney General?"

c) What is the probability of the *union* of the two events in part b? (That is, what is the probability that a randomly selected voter supports the Democratic candidate for Governor *or* the Democratic candidate for Attorney General?)	d) What is the probability that a randomly selected voter supports a Republican for Governor ***and*** a Democrat for Attorney General?	e) What is the probability that a randomly selected voter supports a Republican for Governor ***or*** a Democrat for Attorney General?

3-37 Viola's Method

   a) Does Viola's answer for *3-36 part e* match yours? If not, check your work.
   b) Will Viola's method always work? Why or why not?

3-38 Addition Rule

Adding two probabilities and subtracting the probability of the overlapping event is called the ***addition rule***.

$$P (A \ or \ B) \ = P (A) + P (B) - P (A \ and \ B)$$
$$P (A \ union \ B) \ = P (A) + P (B) - P (A \ intersection \ B)$$

Use the *addition rule* to calculate the probability that a third-party candidate will be elected for either Attorney General or Governor. Then check your results using another method. Show all work.

3-39

	Age						
	Under 25 36%	25 to 34 14%	35 to 44 17%	45 to 54 14%	55 to 64 8%	65 to 74 6%	75 and over 5%
Feta Cheese 10%							
BBQ Chicken 60%							
Asian Ginger 10%							
Chopped Cobb 20%							

(Salad preference)

a) What is the probability that the marketing department will randomly select someone who is 55 or older *and* prefer the BBQ chicken salad?

b) Is the event in part a an *intersection* or a *union*? How does the *intersection* of "55 or older" and "BBQ Chicken" differ from the *union*?

c) Calculate the probability of "55 or older" *or* "BBQ Chicken" using the ***addition rule***. How does this compare to the probability from part a?

d) What is the probability that a randomly selected person from the study is under 75-years-old?

e) Explain how you calculated P(under 75). Then explain a different method for calculating probability of being under 75.

3-40

The ***complement*** is the set of all outcomes in the sample space that are not included in the event.

  a) Show two ways to solve the problem and then decide which way your prefer and explain why. What is the probability that the next person randomly chosen will *not* prefer the BBQ Chicken salad?

  b) If the probability of an event is A is represented symbolically as P(A), how can you symbolically represent the probability of the complement of event A?