THEORETICAL VS EXPERIMENTAL PROBABILITY

Some events can have both a theoretical probability and an experimental probability. Experimental probability comes from collecting DATA (ie: running an experiment and looking at STATISTICS)

Ex. You roll a regular six-sided die 1000 times and 300 times it turns up a "six".
The theoretical probability of rolling a six is 1/6 (there are six sides and one of them has a 6)
The experimental probability of rolling a six is 300/1000 or 3/10 since when you experimented with that die, the data you collected was that out of the 1000 times you rolled it, it turned up six 300 times.

Some events ONLY have an experimental probability which is based on past data:
Ex. Over the past month I counted 100 cars that were red out of a total of 2000 cars.
The experimental probability of spotting a red car is 100/2000 or 1/20.

USING PROBABILITY TO MAKE PREDICTIONS (EXPECTED VALUE)

Whether you know the theoretical or experimental probability of an event, you can use this information to predict how many times you would expect something to occur by multiplying.

Theoretical	Experimental
Ex. A regular six-sided die is rolled 1200 times. How many times would you expect to roll a "3". Since the probability of a "3" is ⅙, we would expect ⅙ of 1200 rolls to be a "3" The expected #of 3s = ⅙ (1200) = 200 times	Ex. In the past, Ms Broden had made typos in 5% of the text messages she sent. If she plans to send 22 text messages this week, how many typos could she expect to make? The expected #typos = 5% of 22 = 0.05 (22) = 1.1 typos

VENN DIAGRAMS

It is often useful to use a Venn diagram to visualize the probabilities of multiple events.

Symbols:

∩ represents the **intersection** of two sets (where they overlap)

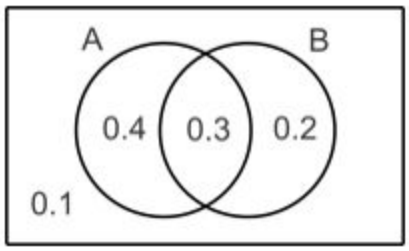
So A ∩ B represents when events A **AND** B both occur

∪ represents the **union** of two sets (joining the sets together)

So A ∪ B represents when events A **OR** B occur

The apostrophe, `, represents the complement of the set, or "everything except"

Let's use the Venn diagram below to find the following probabilities.



In this diagram the numbers themselves represent probabilities.

Notice that the sum of all the values in the diagram is 0.4+0.3+0.2+0.1=1.

This diagram represents the entire **sample space** for two events, A and B.

1. P(A)

   To find the P(A), we will add the probability that only A occurs to the probability that A and B occur to get 0.4+0.3=0.7. So P(A)=0.7. We're adding all probabilities in circle A.

2. P(B) Similarly, P(B) = 0.2 + 0.3
   = 0.5

3. P(A∩B) = the probability that both A **and** B occur
   Now, P(A∩B) is the value in the overlapping region 0.3.

4. P(A ∪ B) = the probability of A **or** B occuring
   P(A ∪ B) = 0.4 + 0.3 + 0.2
   = 0.9

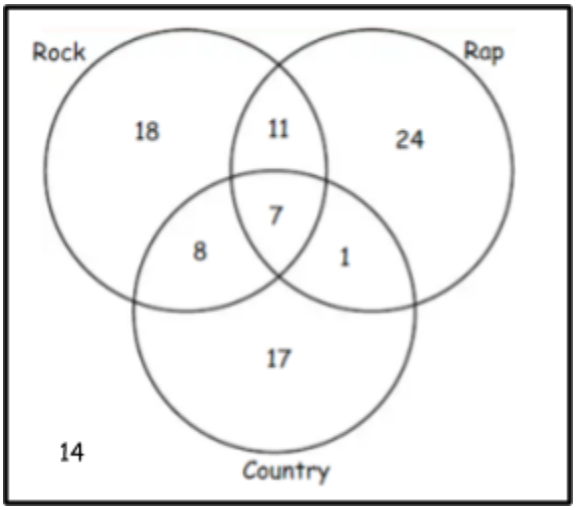
5. P(A∩B)' = the probability of everything EXCEPT A and B occurring

We can either add up everything except the overlap

P(A∩B)' = 0.1 + 0.4 + 0.2 which is 0.7

OR we can subtract the overlap from 1: P(A∩B)' = 1 - 0.3 which is also 0.7

Use the following Venn Diagram to answer each question.



1. How many total people are represented in the diagram?
2. How many people like country music?
3. If one person is chosen at random, what is the probability that they like country music?
4. If one person is chosen at random, what is the probability that the person will like country or rock music?
5. If one person is chosen at random, what is the probability that the person will like country and rock music?
6. If one person is chosen at random, what is the probability that the person doesn't like country or rap or rock music?
7. If one person is chosen at random, what is the probability that the person likes country and rap and rock music?
8. If one person is chosen at random, what is the probability that the person doesn't like country and rap and rock music?

ANSWERS: 1) 100 2) 33 3) 33% 4) 62% 5) 15% 6) 14% 7) 7% 8) 93%