11.3.1

Probability of Multiple Events

Definitions

- **Outcome**: The result of a trial, like flipping a coin, selecting an object, spinning a wheel, or rolling a die
- **Sample** Space: All the possible outcomes
- **Event**: Any outcome (or group of outcomes)
- **Probability**: notated P(event), tells you how likely it is that the event will occur.

Theoretical

- The probability (percentage or fraction) that an outcome SHOULD occur
- All outcomes are equally likely to occur
- $P(event) = \frac{\#\ of\ favorable\ outcomes}{\#\ in\ the\ sample\ space}$

Experimental

- The probability (percentage or fraction) that represents the outcome of an experiment
- $P(event) = \frac{\#\ of\ times\ outcome\ occured}{total\ \#\ of\ trials\ in\ experiment}$

- **<u>Complement of an event</u>**: all outcomes in the sample space that are not in the event.
- For example, if the event is rolling a number less than 3 on a die, the complement of the event is rolling the numbers 3 – 6.
- $P(event) + P(complement) = 1$
- $P(complement) = 1 - P(event)$

- To find the probability of two events occurring together, you have to decide whether one event occurring affects the other event.
- When the occurrence of one event affects how a second event can occur, then the events are **dependent**. If not, the events are **independent**.

Are these events dependent or independent?

- Roll a die then spin a spinner.
- Pick one card then a second (without replacing the first card)
- You pick a coin from a jar. You replace it and select again.

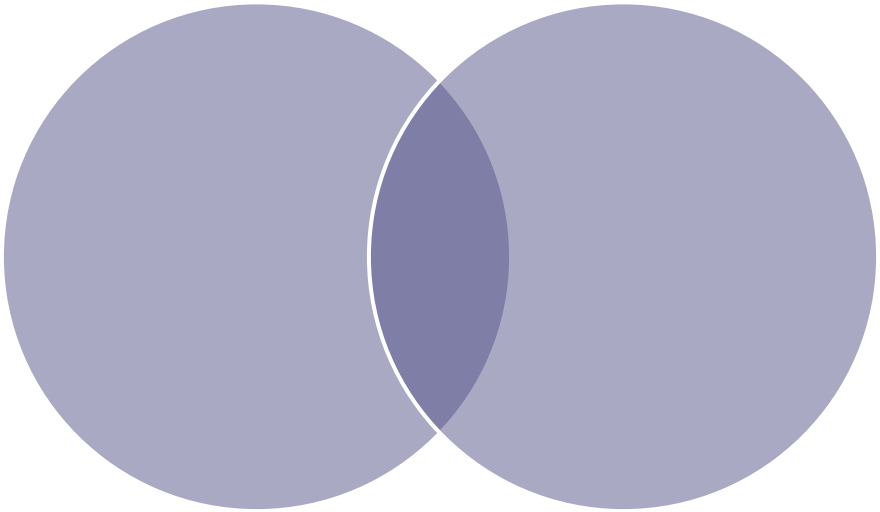
Compound Events

- If A & B are independent events, then the probability that they will happen together is $P(A\ and\ B) = P(A) \cdot P(B)$
- If two events cannot happen at the same time, they are called **<u>mutually exclusive</u>**. The probability they will happen together is 0. $P(A\ and\ B) = 0$
- When events have at least one outcome in common, they are called **<u>overlapping events</u>**

“OR” Probabilities

- Probability of mutually exclusive events:

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



"OR" Probabilities

Probability of Overlapping Events:

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