Conditional Probability: Intermediate: Takeaways

Concepts

- Given events A and B:
    - $P(A)$ means finding the probability of A
    - $P(A|B)$ means finding the conditional probability of A (given that B occurs)
    - $P(A \cap B)$ means finding the probability that both A and B occur
    - $P(A \cup B)$ means finding the probability that either A occurs or B occurs
- For any events A and B, it's true that:

$$P(A|B) = 1 - P(A^C|B)$$
$$P(A^C|B) = 1 - P(A|B)$$

- Knowing what the condition and the event are is important, since P(A|B) is different P(B|A).
- If event A occurs and the probability of B remains unchanged (and vice versa), then events A and B are said to be **independent**. Mathematically, independence between A and B implies that:

$$P(A) = P(A|B)$$
$$P(B) = P(B|A)$$
$$P(A \cap B) = P(A) \times P(B)$$

- If events events A and B are dependent, it means that the occurrence of event A changes the probability of event B and vice versa. In mathematical terms, this means that one of the three equations given above for independence will not hold.
- If three events A, B, C are **mutually independent**, then two conditions must hold: they should be pairwise independent, but also independent together. If any of these two conditions doesn't hold, then the events are not mutually independent.
- The multiplication rule for dependent events:

$$P(A \cap B) = P(B|A) \times P(A)$$

- The mutliplication rule for independent events:

$$P(A \cap B) = P(A) \times P(B)$$
$$P(A \cap B \cap C) = P(A) \times P(B) \times P(C)$$
$$P(A \cap B \cap \ldots) = P(A) \times P(B) \times \ldots$$

Resources

- An intuitive approach to understanding independent events
- An easy intro to some basic conditional probability concepts
- A brief reminder on set complements