Probability

General Rules

- $0 \leq P \leq 1$
  - Probabilities are values between zero and 1.
  - They CANNOT be:
    - Negative
    - Greater than 1
  - They CAN be:
    - Fractions
    - Decimals
    - Percentages
- $P(E) = \dfrac{n(E)}{n(S)}$
  - To find the probability of an event (E), count the number of times the event happens and divide by the total number of outcomes in the sample space (S)

Addition Rules

- $P(E) + P(E^c) = 1$ or $1 - P(E) = P(E^c)$
  - The <u>complement</u> of an event is the probability that event does NOT happen.
  - Two complements add up to 100% or 1.
- OR
  - Mutually Exclusive
    - Two events that do NOT happen at the same time.
    - $P(E \ or \ F) = P(E) + P(F)$
  - NOT Mutually Exclusive
    - Two events that DO happen at the same time.
    - $P(E \ or \ F) = P(E) + P(F) - P(E \ and \ F)$

Multiplication Rules

- AND
  - Independent
    - Two events that are NOT affected by each other.
    - $P(E \text{ and } F) = P(E) * P(F)$
  - Dependent (aka NOT independent)
    - Two events that ARE affected by each other.
    - $P(E \text{ and } F) = P(E) * P(F|E)$
- Fundamental Counting Principle
  - If multiple independent events happen consecutively, the total number of outcomes is found by multiplying the events.
    - $k_1 * k_2 * k_3 * \ldots k_n$
- Conditional Probabilities
  - $P(F|E) = \frac{P(E \text{ and } F)}{P(E)}$
  - The sample space changes based on the condition that is applied.
  - Key words to look out for:
    - If
    - Given that