Addition Rule

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

Ex: roll at least one 1 on two die rolls:

Event A and B are mutually exclusive or disjoint if they cannot both happen.

Ex: H or T, Hillary or Obama (could be neither but not both)

In this case, \( P(A \text{ or } B) = P(A) + P(B) \) because \( P(A \text{ and } B) = 0 \)

Multiplication Rule

\[ P(A \text{ and } B) = P(A)P(B \mid A) \]

\[ := \text{(Prob A happens) times (Prob B happens if A has already happened)} \]

Events A and B are independent if the result of A does not affect the probability of B, otherwise dependent.
Ex: coin tossed, die rolls: \[ P(\text{roll 1 twice}) = \]

When independent, \( P(B|A) = P(B) \), so \( P(A \text{ and } B) = P(A)P(B) \)

**Conditional Probability:**

\[ P(B|A) = \frac{P(A \text{ and } B)}{P(A)} \]

Ex: Suppose the probability that a flight from SJC to LAX leaves on time is 0.8, and the probability of a flight from SJC to LAX both leaves and arrives on time is 0.72. What is the probability for a flight arrives on time if it is known to have left on time?

**Bayes’ Theorem**

\[ P(A|B) = \frac{P(A \text{ and } B)}{P(B)} = \frac{[P(B|A)P(A)]/[P(B|A)P(A) + P(B|\text{not } A)P(\text{not } A)]} \]
EX: You have a two-head quarter, and a regular quarter. You pick one at random (What is the probability of that you picked the one with two heads?)

Flip it and get a Head. What is the probability that it is the two-head one?

Flip it and get a Tail. What is the probability that it is the two-head one?

Text book 3-6 & 3-7

Relative Risk

Odds (in favor of)

Odds Ratio

Rate