Probability Reference Sheet

n Factorial (n!)
\[ n! = n \times (n - 1) \times (n - 2) \times \ldots \times 3 \times 2 \times 1 \]
Ex. 4! = 4 \times 3 \times 2 \times 1 = 24

Permutations
\[ P(n, k) = \frac{n!}{(n-k)!} \]

Combinations
\[ C(n, k) = \frac{n!}{k!(n-k)!} \]

Probability of an Event Occurring
\[ P(E) = \frac{n(E)}{s(E)} \]
\( n(E) = \) number of elements in event E
\( s(E) = \) total elements in sample space s

Odds in favor of an event given Probability
Given probability of an event occurring equal to \( \frac{a}{b} \)
Odds = \( a \) to \( b - a \)

Probability of event occurring given odds
Given odds of event E occurring equal to \( a \) to \( b \)
\[ P(E) = \frac{a}{a+b} \]

Probability of Mutually Exclusive Events
\[ P(A\text{or}B) = P(A) + P(B) \]
Where A and B are mutually exclusive events

Probability of two events
\[ P(A\text{or}B) = P(A) + P(B) - P(A\text{and}B) \]
Where A and B are not mutually exclusive events

Probability of the Compliments of an Event
\[ P(E^c) = 1 - P(E) \]

Conditional Probability
\[ P(B|A) = \frac{P(A\text{and}B)}{P(A)} \]
Probability that B occurs given that A occurs

Expectation
\[ P(S_1) \times S_1 + P(S_2) \times S_2 + P(S_3) \times S_3 + \ldots + P(S_n) \times S_n \]
Where \( S_1, S_2, S_3, \ldots, S_n \) are possible outcomes of an experiment, and \( P(S_1), P(S_2), P(S_3), \ldots P(S_n) \) are the probabilities of those events occurring