Discrete S, equally likely events $\Rightarrow P(event) = \dfrac{\#\ \text{outcomes in event}}{\text{total}\ \#\ \text{outcomes in S}}$

Some useful counting methods via combinatorics are shown below.

4 ways to choose a sample of k elements from a set of n distinct objects

Sample type	**Order matters?**	**Repetition allowed?**	**Number of ways to select sample**
Permutation with replacement	Yes	Yes	n^k
Permutation	Yes	No	$\dfrac{n!}{(n-k)!}$
Combination	No	No	$\dbinom{n}{k} = \dfrac{n!}{k!(n-k)!}$
Combination with replacement	*No*	*Yes*	$\dbinom{n+k-1}{k}$

Permutations: order matters (i.e., *abc*, *cba*, *bca* are all considered "different")

Combinations: order is NOT taken into account (i.e., *ab* = *ba*)

"*n* factorial" = $n! = n(n-1)(n-2)\cdots(2)(1)$. Note 0! = 1.

"*n* choose *k*" = $\dbinom{n}{k} = \dfrac{n!}{k!(n-k)!}$ = binomial coefficient

Stirling's formula: For large *n*, $n! \approx \sqrt{2\pi}\, n^{n+\frac{1}{2}} e^{-n}$

Multinomial coefficient: If you have *n* objects, where n_1 are the same, n_2 are the same, …, n_J are the same such that $n_1 + n_2 + \cdots + n_J = n$,

then the number of distinguishable permutations of these *n* objects = $\dbinom{n}{n_1\ n_2\ \ldots\ n_J} = \dfrac{n!}{n_1!\ n_2!\ \cdots\ n_J!}$. Equivalent statement: