Review - Axioms of Probability

- **Axiom 1** $0 \leq P(E) \leq 1$ for any event E.

- **Axiom 2** $P(S) = 1$.

- **Axiom 3** For a sequence of mutually exclusive events $E_1, E_2, \ldots, E_n, \ldots$

$$P(\cup_{i=1}^{\infty} E_i) = \sum_{i=1}^{\infty} P(E_i)$$

• **The special case of sample spaces with equally likely outcomes**. If $S = \{1, 2, \ldots, N\}$ and all outcomes have equal probability then for any event E

$$P(E) = \frac{\text{number of points in E}}{N}.$$

- Basic principle of counting:

  If r experiments are to be performed such that the first one has n_1 possible outcomes, the second has n_2 possible outcomes, ... , the r-th has n_r outcomes, then the total number of possible outcomes is $n_1 n_2 \ldots n_r$.

- Permutations:

  n objects can be arranged in $n!$ different ordered arrangements.

- If n_1,n_2, ..., n_r of them are indistinguishable such that $n_1 + n_2 + \ldots n_r = n$ then the number of different arrangements is $\frac{n!}{n_1!n_2!...n_r!}$.

- Combinations:

  The number of unordered groups of r items that can be formed out of n items is $\binom{n}{r} = \frac{n!}{r!(n-r)!}$