# 6 Combinatorics Cheatsheet

## 6.1 Overview

- **Combinatorics** is a field of mathematics concerned with:
  - Arrangements of elements of a set into patterns satisfying specific rules, generally referred to as *discrete structures*.
  - The existence, enumeration, analysis, classification and optimization of discrete structures.
  - Generalizations and specializations of relations between discrete structures.

## 6.2 Permutations and Combinations

### 6.2.1 Basic Counting Principles

TODO: addition, multiplication, subtraction, bijection, pigeonhole, double counting

### 6.2.2 Ordered Arrangements

TODO: string, tuple, sequence, map (function), k-permutation, circular permutation

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### 6.2.3 Unordered Arrangements

TODO: subset, k-combination, multiset, k-comb of a multiset, k-perm of a multiset, binomial coefficient

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### 6.2.4 Multinomial Coefficients

- ...

### 6.2.5 The Twelvefold Way

**Twelvefold way**

- ...

## 6.3 Inclusion–Exclusion Principle

**PIE**

TODO: PIE, Möbius Inversion