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Permutations and Combinations

1.1 Basic Counting Principles

Theorem 1.1.1 ▶ Addition Priciple

Let $A_1, A_2, \cdots, A_k$ be k pairwise disjoint finite sets, then

$$\left|\bigcup_{i=1}^{k} A_i\right| = \sum_{i=1}^{k} |A_i| .$$

Theorem 1.1.2 ▶ Multiplication Priciple

Let $A_1, A_2, \cdots, A_k$ be k pairwise disjoint finite sets, then

$$\left|\prod_{i=1}^{k} A_i\right| = \prod_{i=1}^{k} |A_i| .$$

2

Permutations

Definition 2.0.1 ▶ Permutations

Let A be a finite set such that $|A| = n$, an r-permutation of A is a way to arrange r elements of A, denoted as

$$P_r^n = \prod_{i=1}^{r}(n-r+i) = \frac{n!}{(n-r)!}.$$