Combinatorics

We want to choose `k` elements among `n` elements.

	Repetition not allowed	**Repetition allowed**
Order does not matter	$$\frac{n!}{(n-k)!k!}$$ (`n` choices, then `n-1` choices, etc. and we stop at `n-k`, we also remove `n!` because order does not matter and `n!` is the number of permutations)	$$\binom{n-1+r}{n-1}$$ It's stars and bars method. We want `r` stars + `n` stars for each box. Then, we transform `n-1` of these stars into bars to separate the `r` stars into boxes.
Order matters	$$n!$$ (`n` choices, then `n-1` choices, etc.)	$$n^k$$ Cartesian product.

Probabilities

Solving a probability problem

- list possible outcomes, define the probability space
- sometimes we keep a general Ω and different $\mathcal{F}$ depending on the point of view (colorblind/not colorblind, etc.)

Terminology

- Ω is the **sample space**, containing all possible outcomes ω.
- $\mathcal{F}$ is an **event space** (there are multiple event spaces!). It is a set of the subsets of Ω. The powerset of Ω includes all $\mathcal{F}$. $|\mathcal{F}| = 2^{|\Omega|}$ only if Ω is finite.

$\mathcal{F}$ is also called a sigma-algebra.