1. Prove that $\text{Lists}(n, n) = \text{Lists}(n)$ for all $n \in \mathbb{N}$.
2. Show that for all $k \in \mathbb{Z}$ and $x \in R$,
$$\binom{x+1}{k} = \binom{x}{k} + \binom{x}{k-1}.$$
3. Give a combinatorial proof of
$$1 + 2 + \cdots + (n-1) = \binom{n}{2}, \qquad n \in \mathbb{N}.$$
4. Give a combinatorial proof of
$$\sum_{k=0}^{n} \binom{x}{k}\binom{y}{n-k} = \binom{x+y}{n}, \qquad x, y \in R,\ n \in \mathbb{N}.$$
5. Give a combinatorial proof of
$$(1+x)^n = \sum_{k=0}^{n} \binom{n}{k} x^k, \qquad x \in R,\ n \in \mathbb{N}.$$
6. For $n, k \in \mathbb{N}$, let $c(n, k)$ denote the number of k element multisets on $[n]$.

   Show that $c(n, k) = \dfrac{n^{\overline{k}}}{k!}$.