1 Introduction to LaTeX

The section has a particular style, and normal text writing has another typical style. Another nice feature of text writing is that it automatically does justifying, and paragraphs.

To start a new paragraph, just skip a line in the code.

Remark 1. *Another remark.*

1.1 Generating functions so far

So far we've seen:

1. We have
$$\frac{x}{1-x-x^2} = \sum_{n=0}^{\infty} f_n x^n,$$
where $f_0, f_1, \ldots$ is the Fibonacci sequence.

2. We have
$$\frac{1-\sqrt{1-4x}}{2x} = \sum_{n=0}^{\infty} c_n x^n,$$
where $c_0, c_1, \ldots$ is the Catalan sequence.

3. We have
$$(1+x)^m = \sum_{k=0}^{\infty} \binom{m}{k} x^k,$$
where $\binom{m}{0}, \binom{m}{1}, \ldots$ are generalized binomial coefficients.

1.2 More things to count

We will be counting ways of breaking things into pieces, such as

(a) Integer partitions — ways of breaking numbers into parts,

(b) Integer compositions — ways of breaking numbers into parts but keeping track of order,

(c) Set partitions — ways of breaking up sets into parts,

(d) Set compositions — ways of breaking up sets into parts but keeping track of order.

1.2.1 Set partitions

A *set partition* $A = \{A_1, A_2, \ldots, A_\ell\}$ of a set S is a set of subsets $\{A_1, \ldots, A_\ell\}$ with $A_j \subseteq S$ for $1 \leq j \leq \ell$, such that

- $S = A_1 \cup A_2 \cup \cdots \cup A_\ell$,
- for each $1 \leq i < j \leq \ell$, we have $A_i \cap A_j = \emptyset$.

Remark 2. *We usually refer to the subsets of a set partition as the* blocks *or* parts *of the set partition.*

These lead to the following numbers.

$$b_n = \# \left\{ \begin{array}{c} \text{set partitions} \\ \text{of } \{1, 2, \ldots, n\} \end{array} \right\} \qquad \text{(Bell numbers)}$$

$$S(n,k) = \# \left\{ \begin{array}{c} \text{set partitions} \\ \text{of } \{1, 2, \ldots, n\} \\ \text{with } k \text{ blocks} \end{array} \right\} \qquad \text{(Stirling numbers of the second kind)}$$

1.3 Other things to pay attention to

Note that "a" is in a different font than a. Matrices are done with the array environment

$$\left(\begin{array}{c|cccc} 1 & 2 & 3 & 4 & 5 \\ \hline 0 & 1 & 2 & 3 & 4 \\ -1 & \text{this} & \binom{4}{2} & x^3 & 0 \end{array} \right).$$

To do $\mathbb{Z}$ one uses the math blackboard bold font. I use the macro $\mathbb{Z}$. Greek letters are easy: α, β, γ, or Γ, Ξ.

Quote are a little funny. If I just do quotes the ”usual” way, then it looks wrong, so instead for the begin quotes I need to use “this” and then the usual thing for finishing.

$a \in B$ but $b \notin A$. Let $f : A \to B$ be a function, or let

$$f : A \longrightarrow B$$

be a function.

By Remark 2, we have that BLAH, and by Section 1.2.1, we have BLAH.