APPENDIX A WHAT DO WE MEAN WHEN WE WRITE ...?

If, while reading the book, you encounter some symbol that you do not understand, this table helps explain what we mean.

$\{2, 5, 6\}$	*a set*: you can imagine this as a bag that contains the numbers 2, 5, and 6.
$5 \in \{2, 5, 6\}$	*element in a set*: indicates that a certain element (e.g., 5) is contained in the set (e.g., $\{2, 5, 6\}$).
$\#\{2, 5, 6\}$	*number of elements in a set*: $\#\{2, 5, 6\} = 3$; also denoted by $\lvert\{2, 5, 6\}\rvert$.
$\{2, 5, 6\} \setminus \{2, 6\}$	*set difference*: removes certain elements from a set; here: $\{2, 5, 6\} \setminus \{2, 6\} = \{5\}$.
$\{2, 5\} \cap \{5, 7\}$	*set intersection*: contains all elements that are in both sets; here: $\{2, 5\} \cap \{5, 7\} = \{5\}$. If the intersection is empty, the sets are called *disjoint*.
$\{2, 5, 6\}^k$	*power of a set*: this set contains 3^k k-tuples (e.g., $\{2, 5, 6\}^2 = \{(2, 2), (2, 5), (2, 6), (5, 2), (5, 5), (5, 6), (6, 2), (6, 5), (6, 6)\}$).
$\mathbb{N}$	*natural numbers*: $0, 1, 2, 3, \ldots$.
$\mathbb{Z}$	*integers*: as above, but includes negative numbers, too: $\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots$.

$\mathbb{Q}$ *rational numbers*: all fractions, such as $2/3$, $-4/17$, and $122/4$, but also 0 and -32.

$\mathbb{R}$ *real numbers*: all rational numbers, together with so-called "irrational numbers," such as $\sqrt{2}$, $\sqrt[5]{7}$, and $\pi \approx 3.1416$.

$\mathbb{C}$ *complex numbers*: each complex number is of the form $a + i \cdot b$ for some $a, b \in \mathbb{R}$. We can add, subtract, multiply, and divide complex numbers, using $i^2 = -1$ (e.g., $(2 + i \cdot 3) + (1 + i \cdot 5) = 3 + i \cdot 8$ and $(4 + i \cdot 1)^2 = 15 + i \cdot 8$); see appendix B.8.

$\lim_{n\to\infty} a_n$ *limit of a sequence*: see appendix B.2.

$a!$ *factorial of a*: in this book, defined for natural numbers; $a! = a \cdot (a-1) \cdot (a-2) \cdot \cdots \cdot 2 \cdot 1$ (e.g., $4! = 4 \cdot 3 \cdot 2 \cdot 1 = 24$ and $14! = 87178291200$). Usually, $0!$ is defined as 1.

a^b *exponentiation*: if b is a natural number, this is short-hand notation for $a \cdot a \cdot \cdots \cdot a$ (b times) (e.g., $2^3 = 2 \cdot 2 \cdot 2 = 8$); see appendix B.3 for the general case.

$a \mapsto f(a)$ *function (or mapping)*: you can think of this as a machine that takes some input a and outputs $f(a)$ (e.g., $f(a) = \frac{1}{a}$). To be more specific, one sometimes add $f : A \to B$ to indicate what type of elements are allowed to enter f, and what type of elements are output. In the example above, one could write $f : \mathbb{R} \setminus \{0\} \to \mathbb{R}$.

exp *exponential function*: arguably the most important function in mathematics; see appendix B.3.

$\log_2$	*logarithm to the base 2*: related to the inverse function of exp; see appendix B.3.
$\sum_{a\in A} f(a)$	*sum*: a short-hand notation for sums with many summands (e.g., $\sum_{a\in\{2,5,7\}} a = 2+5+7$, and $\sum_{a=13}^{20} \frac{1}{a} = \frac{1}{13} + \frac{1}{14} + \cdots + \frac{1}{20}$).
P	*probability*: the probability of a certain event; see appendixes B.5 and B.6.
$\mathbf{E}$	*expectation*: the value of a random variable that we expect to see on average. Also called the *mean* of that variable; see appendixes B.5 and B.6.