

# Chapter 7

## Probability.

**Definition 7.0.1.** A probability space defined by a tuple  $(\Omega, P)$  such that:

1.  $\Omega$  is a set, called the sample space. Any element  $\omega \in \Omega$  is named an atomic event. Conceptually, we think of atomic events as possible outcomes of our experiment. Any subset  $A \subset \Omega$  is an event.
2.  $P$ , called the probability function, is a function that assigns a number in  $[0, 1]$  to any event, denoted as  $P : 2^\Omega \rightarrow [0, 1]$ , and satisfies:
  - (a) For any event  $A \subset \Omega$ ,  $P(A) = \sum_{\omega \in A} P(\omega)$ .
  - (b) Normalization, over the atomic events, to 1, which means  $\sum_{\omega \in \Omega} P(\omega) = 1$ .

**Example 7.0.1.**

**Result:** Sorting  $A_1, A_2, \dots, A_n$

```
1 for  $i \in [n]$  do
2   for  $j \in [n]$  do
3     if  $A_i < A_j$  then
4        $\text{swap } A_i \leftrightarrow A_j$ 
5     end
6   end
7 end
```

**Algorithm 1:** "ICan'tBelieveItCanSort" alg.