



### Why

Suppose we flip a coin  $n$  times. How should we define a probability distribution on  $\{0, 1\}^n$ . Suppose instead we flip  $n$  different coins, each once. How now?

### Discussion

If we model the outcome that coin  $i$  lands heads as 1 and that it lands tails by 0, then we are asking to treat of uncertain outcomes from the set  $\{0, 1\}^n$  of length-2 sequences.

Here  $x \in \{0, 1\}^n$  could correspond to the outcome of flipping one coin  $n$  times or the outcome of flipping  $n$  different coins. This is a simple example of a frequent and obvious phenomenon in mathematics wherein the same mathematical model (here the outcome set) can be used to model different situations in the real world (c.f. numbers, etc.).

### Definition

Consider a distribution over a product of  $n$  sets, where the product is indexed by the first  $n$  natural numbers. We call the distribution a *joint distribution* with  $n$  components.



