

Probabilities

Axioms of Probability

1. For any event A , $0 \leq P(A) \leq 1$.
2. $\Omega \in \mathcal{F} \Rightarrow P(\Omega) = 1$
3. $P(\cup_i A_i) = \sum_i P(A_i)$

Where \mathcal{F} is the *domain* of the probability measure P

Introduction

- Experiment : Process whose outcome is not known in advance.
- Sample space : Set Ω of all *possible* outcomes from the experiment.
- Event : Subset of Ω . *Statement* about the outcome of an experiment.

Example : When rolling 2 dice : There are $6^2 = 36$ outcomes $\Omega = \{(m, n) : 1 \leq m, n \leq 6\}$. If we state that only '*the sum is 9*' then : $B = \{(6, 3), (5, 4), (4, 5), (3, 6)\}$

Additivity

If A_1, A_2, A_3, \dots are **disjointed** events, that is *two events cannot happen at the same time* (i.e. $A_i \cap A_j = \emptyset$ for all $i \neq j$) then :

$$P\left(\bigcup_{i=1}^{\infty} A_i\right) = \sum_{i=1}^{\infty} P(A_i)$$

The addition in *disjoint* means calculates the **total chance that one or the other** happens.

Summary: