**Chapter 2: Probability**

A **random experiment** is a mechanism that **produces a definite outcome** that **cannot be predicted** with certainty.  
 Ex: Rolling a dice. There can be 6 possible outcomes {1, 2, 3, 4, 5, 6}. However, none of the outcomes can be exactly predicted.  
 🡪 Rolling a dice: a random experiment

When a random experiment is repeated many times each one is known as **a trial**.  
 Ex: roll a dice once: a trial.

The **sample space S** of a random experiment is the **collection of all possible outcomes**.  
 Ex: Roll a dice and record number dots. 🡪

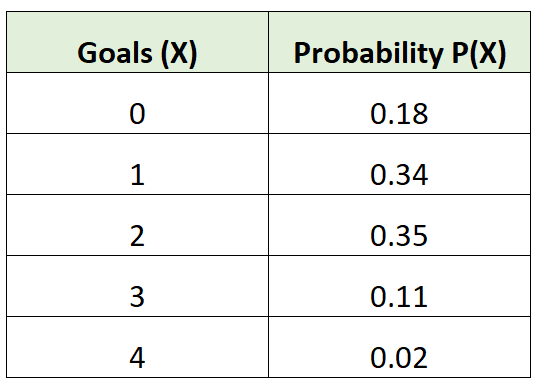
Flip a coin and record face up → S = {H, T}

Flip 3 coins, record the number of H → S = {0, 1, 2, 3}

An **event E** associated with a random experiment is a **subset of the sample space**.  
 Ex:

The **probability P** of any outcome is a number **between 0 and 1**.   
The probabilities of all the outcomes add up to 1.   
The **probability of an event** is **the sum of the probabilities of the outcomes in E**.  
 Ex1:

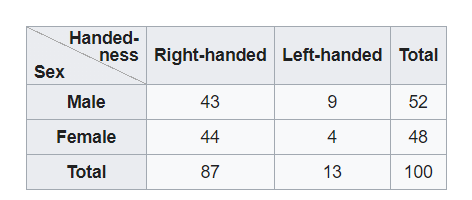
X: number of dots when tossing a dice.

🡪 probability distribution

P(X=2) = 0.35

P(X>2) = P(X=3) + P(X=4) =0.11 + 0.02 = 0.13

P(X=5)=0

 🡪 contingency table

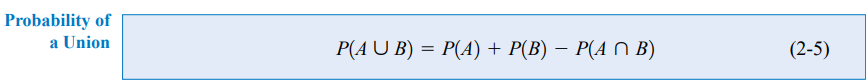
**Basic set operations**

The **union** of two events is the event that consists of **all outcomes that are contained in either of the two events**. We denote the union as ***E*1∪*E*2**.

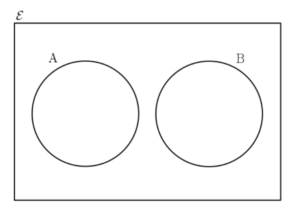
The **intersection** of two events is the event that consists **of all outcomes that are contained in two events**. We denote the intersection as ***E*1∩*E*2**.

The **complement of an event** in a sample space is the set of outcomes in the sample space that are not in the event. We denote the component of the event E as E’.

**Additional rule**



**Mutually exclusive events**

**Events A and B** are said to be **mutually exclusive** if it is **not possible** that **both occur at the same time**.   
 Ex: Toss of a coin.   
 Let A be the event that the coin lands on heads  
 Let B be the event that the coin lands on tails.   
 🡪 In a single fair coin toss, events A and B are mutually exclusive. 

**Independent events**

**Events A and B** are said to be i**ndependent** if the **probability of B occurring is unaffected by the occurrence of the event A happening**.   
 Ex: Tossing a coin twice.   
 Let A be the event that the first coin toss lands on heads.   
 Let B be the event that the second coin toss lands on heads.   
 🡪 Clearly the result of the first coin toss does not affect the result of the second coin toss.  
 🡪 Events A and B are independent.

**---------------------------------------------------------------------------------------------------------------------------------------------------- Conditional probability** keyword \*if, \*given that **🡪 Decision tree**

Graphical user interface, text, application

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**Bayes’ Theorem**

Text

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