PROBABILITY

Lesson

VOCABULARY

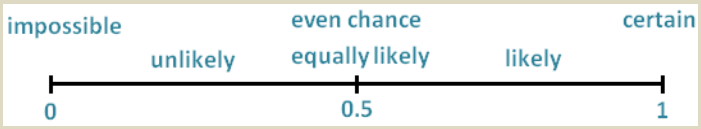
| An **experiment** / A **trial** | is an action where the result is uncertain.

An **outcome** is the result of an experiment.

The **sample space** is the set of all possible outcomes of an experiment.
Examples
Experiment Rolling a die once: Sample space S = {1,2,3,4,5,6}
Experiment Tossing a coin: Sample space S = {Heads,Tails}

An **event** is any collection of outcomes of an experiment.
Examples
"Getting a Tail when tossing a coin" is an event.
"Rolling a 5" is an event.
"Rolling an even number" is an event.

A **probability** provides a quantitative description of the likely occurrence of a particular event. Probability is expressed on a scale from 0 to 1. A rare event has a probability close to 0, and a very common event has a probability close to 1.



HISTORY-origin

before 1654: discussions about statistics and outcomes
1654: Pascal and Fermat create the mathematical theory of probability.

EQUALLY LIKELY OUTCOMES

Equally likely outcomes are outcomes that have the same probability of occurring.
In this case,

$$P(A) = \frac{number\ of\ outcomes\ corresponding\ to\ event\ A}{total\ number\ of\ outcomes}.$$

Example 1 Throwing a die

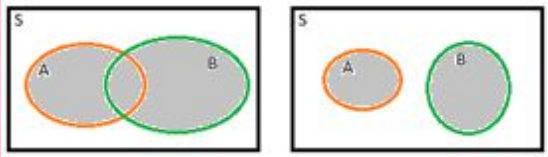
When a die is thrown, there are 6 possible outcomes: 1, 2, 3, 4, 5 and 6.
The probability of any one of them is $\frac{1}{6}$.

Example 2 Tossing a coin

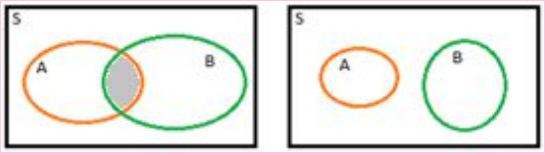
When a coin is tossed, there are two possible outcomes.
We assume that the results "Heads" or "Tails" each have equal probabilities of 0.5. (The probability of the coin landing Heads is 0.5, and the probability of the coin landing Tails is 0.5.)

SET NOTATION AND VENN DIAGRAM

$A \cup B$ ("A **union** B"): either A or B occurs, or both occur



$A \cap B$ ("A **intersection** B"): both A and B occur



$\bar{A}$ ("the **complementary event** of A"): A does not occur

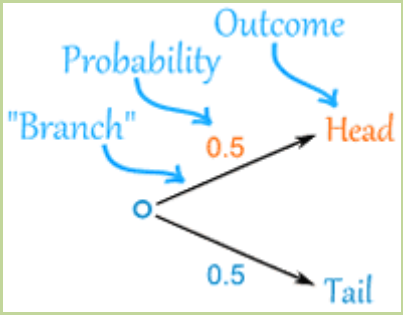
Ø ("the **empty set**"): an impossible event
S ("the **sample space**"): an event that is certain to occur
A and B are **mutually exclusive** if their intersection is the empty set.

ADDITION RULE

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

TREE DIAGRAMS

Here is a **tree diagram** for the toss of a coin :



Each path represents an outcome which is written at the end of the branch.
The probability of each branch is written on the branch.

-> See : PROBABILITY Tree diagrams