PROBABILITY

Ever wondered if it'll rain tomorrow or if you'll win a game? That's probability! It's a math way to guess how likely things are to happen. Like when the weather app says there's a 90% chance of rain, that's probability telling us it's very likely. What else do you think we could use probability for?

A OUTCOME

Have you ever flipped a coin and wondered if it'd land on heads or tails? Or rolled a die and guessed what number you'd get? These are random experiments—things we do where the result isn't certain until it happens.

Definition Outcome

An **outcome** is one possible result of a random experiment.

Definition All Possible Outcomes

All possible outcomes are the complete list of everything that could happen in a random experiment.

Ex: What do you think are all the possible outcomes when you flip a coin? 

Answer: All possible outcomes are Heads (H) and Tails (T).

Ex: Can you list all the possible outcomes when you roll a six-sided die?

Answer: All possible outcomes are 1=  ,2=  ,3=  ,4=  ,5=  ,and 6=  .

B EVENTS

Definition Event

An **event** is a set of outcomes from all possible outcomes.

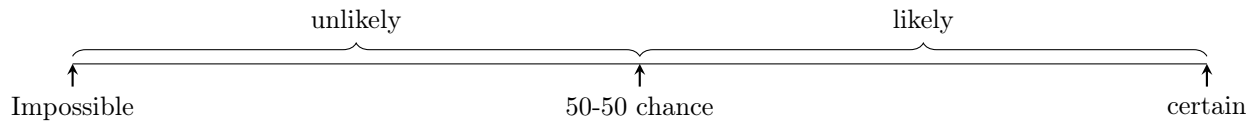
Ex: In the experiment of rolling a standard die, find the outcomes that correspond to rolling an even number.

Answer: The outcomes for "rolling an even number" are 2=  ,4=  ,and 6=  .

C USING WORDS TO DESCRIBE PROBABILITY

We often use words to talk about probability. If something will never happen, it's impossible. If it will definitely happen, it's certain. In between, we say things like 'likely,' '50-50 chance,' or 'unlikely.' We can line them up from least to most likely.

Definition Probability Line



Ex: When you flip a coin, what's the chance it lands on heads?

Answer: The probability of the coin landing on heads is a 50-50 chance.

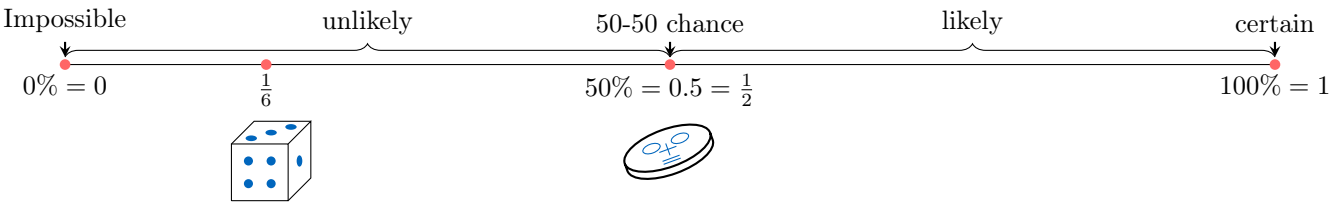
D USING NUMBERS TO QUANTIFY PROBABILITY

Imagine two basketball players, Hugo and Louis, who are both great at free throws. Fans say Louis is better, but that's not specific. We need numbers to compare them accurately. Probability gives us those numbers!

Definition Probability

The **probability of an event**, written $P(\text{event})$, is a number that tells us how likely the event is to happen. It's always between 0 (impossible) and 1 (certain).

We can write probability as a fraction, decimal, or percentage. For example, a 50-50 chance is $\frac{1}{2}$, 0.5, or 50%. On a number line, 0 is impossible, 1 is certain, and 0.5 is in the middle.



Ex: What's the probability the sun will rise tomorrow?

Answer: The probability that the sun will rise tomorrow is 1, or 100%.

E CALCULATE PROBABILITIES

Sometimes, every outcome in an experiment has the same chance—like flipping a fair coin or rolling a fair die. We call these equally likely outcomes.

Definition **Equally Likely**

If all outcomes are equally likely, the probability of an event is given by

$$P(\text{"event"}) = \frac{\text{number of outcomes in the event}}{\text{total number of all possible outcomes}}$$

Ex: Find the probability of rolling an even number with a fair six-sided die.

Answer:

- The total number of possible outcomes when rolling the die is 6, as there are 6 faces altogether.
- The number of outcomes for rolling an even number is 3, as there are three even numbers on the die: 2, 4, and 6.
- Therefore, the probability of rolling an even number is given by:

$$\begin{aligned} P(\text{rolling an even number}) &= \frac{\text{number of outcomes in the event}}{\text{total number of possible outcomes}} \\ &= \frac{3}{6} \\ &= \frac{1}{2} \end{aligned}$$