

MATHEMATICS • CLASS 9

CHAPTER 7

The Mathematics of Maybe

Introduction to Probability

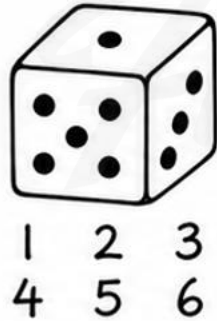
CHAPTER NOTES



PROBABILITY AND RANDOMNESS

Probability measures how likely an event is to occur. It describes uncertainty; it does not predict the exact result of a single trial.

Randomness: We know the possible results, but cannot tell which one will occur in advance. A random experiment is a repeatable action with an uncertain result. One performance is a trial.



Examples: tossing a coin, rolling a die, drawing a student's name at random.

Judgement and evidence:

- Subjective probability uses personal judgement about the evidence.
- Objective estimates use experimental data or a mathematical model.
- Weather is affected by many interacting factors, so rainfall predictions are uncertain.

Fair and unbiased:

A fair coin does not favour either side.

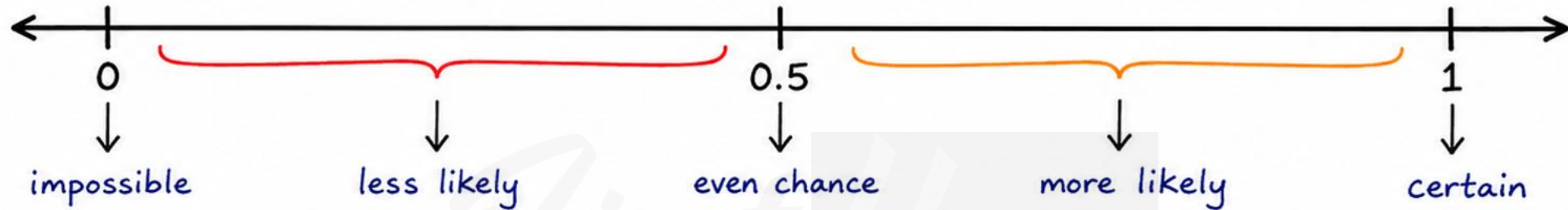
A random toss allows the coin to fall freely without interference.

$$P(H) = P(T) = \frac{1}{2}$$

THE PROBABILITY SCALE

$$0 \leq P(E) \leq 1$$

- Larger probabilities mean an event is more likely.
- Multiply a probability by one hundred to write a percentage.



★ Fair die, number greater than 6	→	0
★ Fair die, rolling 3	→	$\frac{1}{6}$
★ Fair coin, heads	→	$\frac{1}{2} = 0.5 = 50\%$
★ Random card from standard 52-card deck, number 2 to 10	→	$\frac{36}{52} = \frac{9}{13}$
★ Bag containing only red sweets, picking red	→	1



A fifty-percent chance of winning means an equal chance of winning and NOT winning. If a draw is possible, not winning does not mean only losing.

OUTCOMES AND SAMPLE SPACES

An outcome is one possible result of an experiment. The sample space is the set of all possible outcomes. Write it as S in braces, without repeating outcomes. $n(S)$ means the number of outcomes in the sample space.

Experiment	Sample space S	$n(S)$
Coin toss	$\{H, T\}$	2
Die roll	$\{1, 2, 3, 4, 5, 6\}$	6
Match result	$\{\text{Win, Lose, Draw}\}$	3
Two labelled coins	$\{HH, HT, TH, TT\}$	4
Rain or no rain	$\{\text{Rain, No rain}\}$	2

- In a two-coin outcome, the first letter records coin one and the second records coin two. HT and TH are different outcomes.
- The level of detail should match the investigation; rainfall can be grouped more finely if needed.
- Important: Listing outcomes does not automatically make them equally likely. A match can have three possible results without each having probability one-third.

→ Here $n(S)$ is sample-space size; it is not the number of surveyed people.

EVENTS AND FAVOURABLE OUTCOMES

An event is a chosen set of outcomes from a sample space. It is a subset of that sample space. The outcomes belonging to the event are favourable outcomes.

① Die roll:



$$S = \{1, 2, 3, 4, 5, 6\}$$

event 'greater than four': $E = \{5, 6\}$

② Two labelled coins:

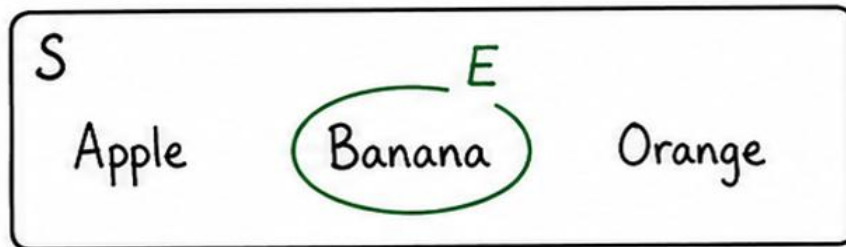


$$S = \{HH, HT, TH, TT\}$$

event 'at least one head': $E = \{HH, HT, TH\}$

At least one includes exactly one and also two heads.

③ Fruit type:



$$S = \{\text{Apple}, \text{Banana}, \text{Orange}\}$$

event 'picking a banana': $E = \{\text{Banana}\}$

An event may contain one outcome or several outcomes. Count all favourable outcomes, not just one example.

Knowing three fruit types does not imply each type is equally likely; their amounts also matter.



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