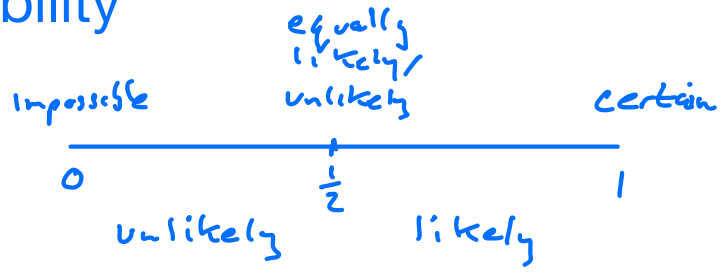
Bassic Probability

Scale



Three ways to record probability

	Fractions	Percentages	Decimals
eg	$\frac{1}{2}$	50%	0·5
	$\frac{1}{4}$	25%	0·25

You must not use ratios such as 50:50

A die (or dice) if fair can give a

1, 2, 3, 4, 5, 6 as the outcome of a roll

Prob(1) or $P(1) = \frac{1}{6}$

$P(2) = \frac{1}{6}$

$P(3) = \frac{1}{6}$

$P(4) = \frac{1}{6}$

$P(5) = \frac{1}{6}$

$P(6) = \frac{1}{6}$ +

$\frac{}{1}$

Mutually Exclusive events are events which

cannot both happen at the same time

The 'OR' Rule

If two events A and B are mutually exclusive then the probability of A or B happening written as $P(A \cup B)$ is given by

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

Ex $P(5 \cup 6) = P(5) + P(6)$

$= \frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$

because rolling a 5 or a 6 are mutually exclusive events

Not all events are mutually exclusive

Ex Let A be the event roll an even number

Let B be the event roll number > 3

Then $P(A) = \frac{3}{6}$ $P(B) = \frac{3}{6}$

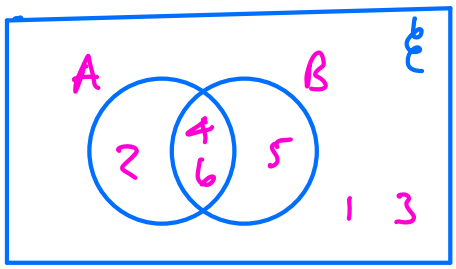
But $P(A \cup B) = \frac{4}{6}$ not $\frac{6}{6}$

$\{2, 4, 6, 5\}$

The probabilities for A and B could not simply added together because A and B are not mutually

exclusive. 4 and 6 are in both A and B.

Venn Diagram



$P(A \cup B) = \frac{4}{6}$

= Prob of A or B or both

$P(A \cap B) = \frac{2}{6}$

= Prob of both A and B happening

$A \cup B$ is the union of A and B

$A \cap B$ is the intersection of A and B

Expected Values

Spin a coin 50 times. How many Heads would you expect? Equally likely as Tails

Expected value $= 50 \times \frac{1}{2} = 25$

= number of trials x prob of success

Roll a Dice 60 times. How many 5s would you expect? 10

$60 \times \frac{1}{6} = 10$

Class Experiment Spinning Coin 10 times

	H	T
Trial 1	4	6
Trial 2	3	7
Trial 3	7	3
Trial 4	5	5

From this trial estimate the probability of getting 4 or less heads in 10 spins

It happened twice in 4 trials

so estimate is 50%

By Sixth Form Calculator

10 spins $P(\leq 4 \text{ heads}) = 0.377$

100 spins $P(\leq 40 \text{ heads}) = 0.028$

1000 spins $P(\leq 400 \text{ heads}) = 1.36 \times 10^{-10}$

$= 0.000000000136$

1000 spins $P(\leq 450 \text{ heads}) = 0.000865$

1000 spins $P(\leq 475 \text{ heads}) = 0.061$

1000 spins $P(\leq 460 \text{ heads}) = 0.00622$

1000 spins $P(\leq 465 \text{ heads}) = 0.0145$

1000 spins $P(\leq 463 \text{ heads}) = 0.0105$

1000 spins $P(\leq 462 \text{ heads}) = 0.00883$

If you spin a coin 1000 times there is a 99% chance the number of heads will be

$$460 \leq \text{number of heads} \leq 540$$

Experimental Probability

A drawing pin is dropped on the floor 100 times. It can land like

If it lands like 57 times

then we estimate that the probability of landing like that is $\frac{57}{100}$ or 57%