Cambridge Assessment International Education

NEW ERA international school

Unit 19 Probability

Checkpoint 1&2

What is probability?

- Probability is how likely it is that a particular result will occur
- A chance that something will happen

Very Unlikely боломж багатай

- Unlikely is a very small chance of happening

Likely боломж ихтэй

- Likely is a good chance of happening

Certain 100% боломж

- A result that will always occur (100%)

Equally Likely Тэнцүү боломж

- Results that have an equal chance of occurring

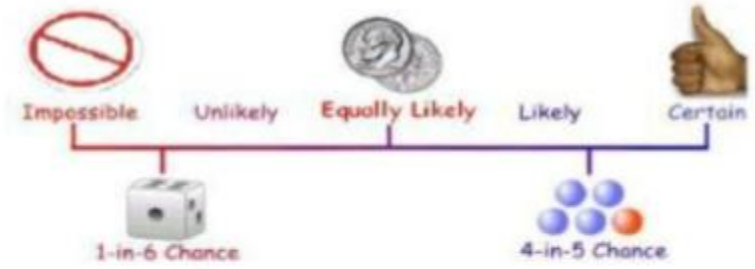
Impossible

- A result that cannot occur

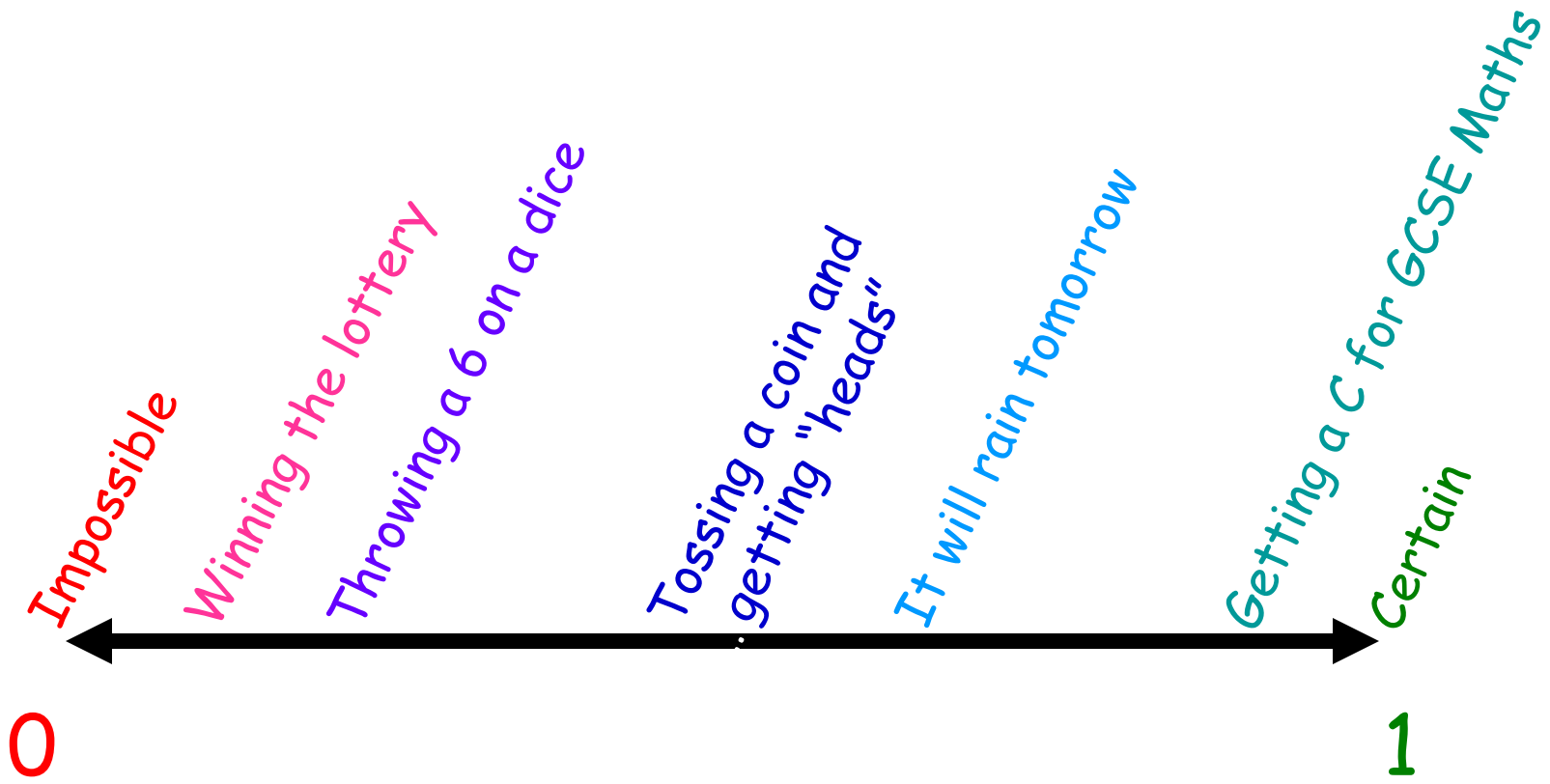
боломжгүй

Probability Line

- A way to show probabilities of several outcomes

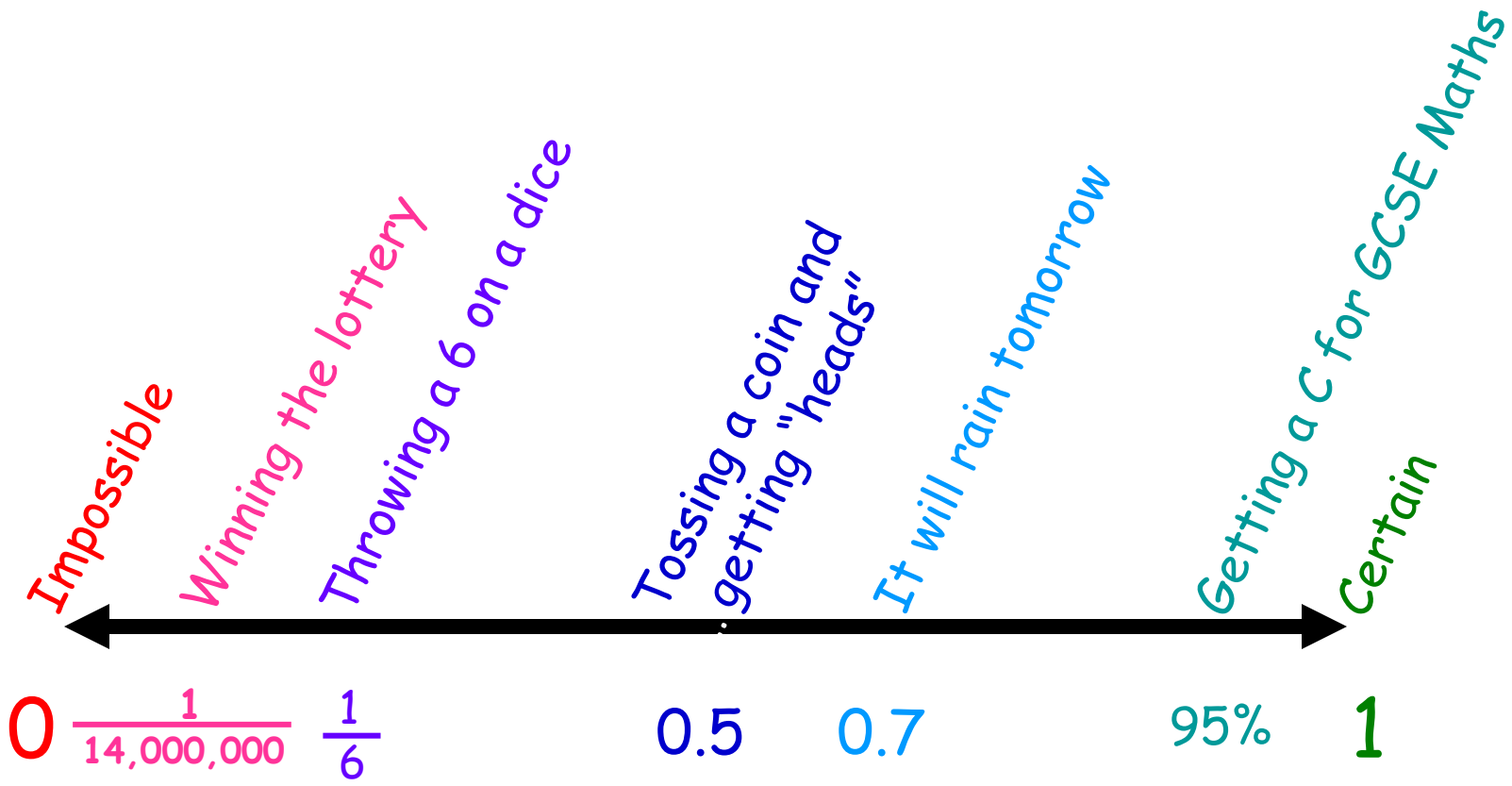


Probability- магадлал



All probabilities lie somewhere on a scale between "**Impossible**" and "**Certain**"

The probability scale goes from 0 to 1



Probabilities can be expressed either as fractions or as decimals (and sometimes as percentages)

Probability

dice –шоо

The probability of throwing a 6 with a fair dice is $\frac{1}{6}$

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

So the probability of **not** throwing a 6 is $\frac{5}{6}$

$$P(\text{not } 6) = 1 - \frac{1}{6} = \frac{5}{6}$$

If the probability that it will rain tomorrow is 0.7 …..

$$P(\text{rain}) = 0.7$$

Then the probability that it will **not** rain tomorrow is 0.3

$$P(\text{not rain}) = 1 - 0.7 = 0.3$$

Suppose I toss a coin:

What is the probability of getting a head?

0.5, $\frac{1}{2}$ or 50%

Suppose I toss two coins:

If I toss the coin twice, I would get one of these combinations:

Heads, Heads		H, H
Heads, Tails	or	H, T
Tails, Heads		T, H
Tails, Tails		T, T

What is the probability of getting two heads?

Only one of these four combinations is two heads

Suppose I toss two coins:

If I toss the coin twice, I would get one of these combinations:

Heads, Heads		H, H
Heads, Tails	or	H, T
Tails, Heads		T, H
Tails,Tails		T, T

What is the probability of getting two heads?

Only one of these four combinations is two heads

So the probability of getting a two heads in a row is $\frac{1}{4}$

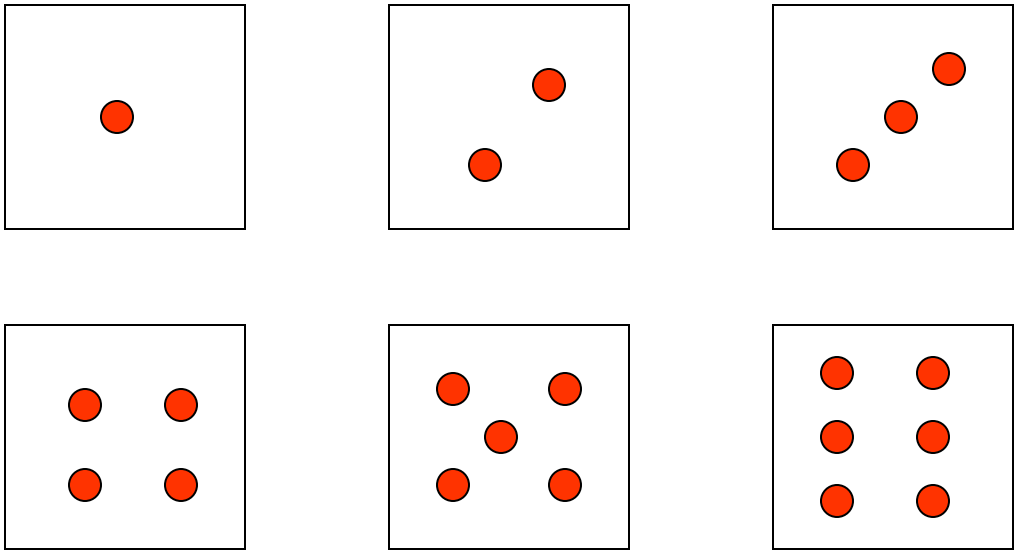
A Sample Space is a list of all the possible outcomes,
e.g. HH, HT, TH, TT
We can show this in a Sample Space Diagram:

First Coin \ Second Coin	H	T
H	H, H	H, T
T	T, H	T, T

There are 4 possible outcomes if you toss a coin twice

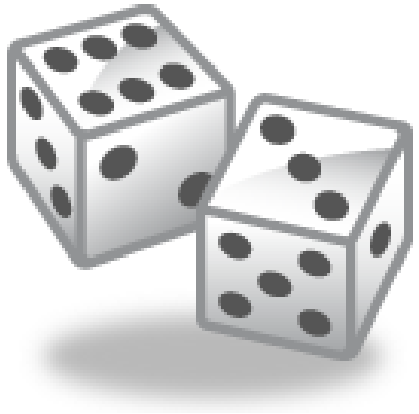
So the probability of two heads is $\frac{1}{4}$

Suppose I throw a die.



There are 6 equally likely outcomes.

Suppose I throw two dice.



Suppose I throw two dice.

We can show the possible outcomes in a Sample Space Diagram:

First Dice \ Second Dice	1	2	3	4	5	6
1	1, 1	1, 2	1, 3	1, 4	1, 5	1, 6
2	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6
3	3, 1	3, 2	3, 3	3, 4	3, 5	3, 6
4	4, 1	4, 2	4, 3	4, 4	4, 5	4, 6
5	5, 1	5, 2	5, 3	5, 4	5, 5	5, 6
6	6, 1	6, 2	6, 3	6, 4	6, 5	6, 6

There are 36 (6 x 6) possible outcomes if you throw two dice.

If you throw two dice, what is the probability of getting a "double"?

Second Dice

First Dice	1	2	3	4	5	6
1	1, 1	1, 2	1, 3	1, 4	1, 5	1, 6
2	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6
3	3, 1	3, 2	3, 3	3, 4	3, 5	3, 6
4	4, 1	4, 2	4, 3	4, 4	4, 5	4, 6
5	5, 1	5, 2	5, 3	5, 4	5, 5	5, 6
6	6, 1	6, 2	6, 3	6, 4	6, 5	6, 6

If you throw two dice, what is the probability of getting a "double"?

Second Dice

First Dice	1	2	3	4	5	6
1	1, 1	1, 2	1, 3	1, 4	1, 5	1, 6
2	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6
3	3, 1	3, 2	3, 3	3, 4	3, 5	3, 6
4	4, 1	4, 2	4, 3	4, 4	4, 5	4, 6
5	5, 1	5, 2	5, 3	5, 4	5, 5	5, 6
6	6, 1	6, 2	6, 3	6, 4	6, 5	6, 6

6 out of the 36 possible outcomes are "doubles",
so the probability is $\frac{6}{36}$

If you throw two dice, what is the probability of getting a "double"?

Second Dice

First Dice	1	2	3	4	5	6
1	1, 1	1, 2	1, 3	1, 4	1, 5	1, 6
2	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6
3	3, 1	3, 2	3, 3	3, 4	3, 5	3, 6
4	4, 1	4, 2	4, 3	4, 4	4, 5	4, 6
5	5, 1	5, 2	5, 3	5, 4	5, 5	5, 6
6	6, 1	6, 2	6, 3	6, 4	6, 5	6, 6

6 out of the 36 possible outcomes are "doubles",
so the probability is $\frac{1}{6}$

What is the probability of scoring 9 or more?

Second Dice

First Dice	1	2	3	4	5	6
1	1, 1	1, 2	1, 3	1, 4	1, 5	1, 6
2	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6
3	3, 1	3, 2	3, 3	3, 4	3, 5	3, 6
4	4, 1	4, 2	4, 3	4, 4	4, 5	4, 6
5	5, 1	5, 2	5, 3	5, 4	5, 5	5, 6
6	6, 1	6, 2	6, 3	6, 4	6, 5	6, 6

What is the probability of scoring 9 or more?

Second Dice

First Dice	1	2	3	4	5	6
1	1, 1	1, 2	1, 3	1, 4	1, 5	1, 6
2	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6
3	3, 1	3, 2	3, 3	3, 4	3, 5	3, 6
4	4, 1	4, 2	4, 3	4, 4	4, 5	4, 6
5	5, 1	5, 2	5, 3	5, 4	5, 5	5, 6
6	6, 1	6, 2	6, 3	6, 4	6, 5	6, 6

10 out of the 36 possible outcomes add up to 9 or more, so the probability is $\frac{10}{36}$

What is the probability of scoring 9 or more?

Second Dice

First Dice	1	2	3	4	5	6
1	1, 1	1, 2	1, 3	1, 4	1, 5	1, 6
2	2, 1	2, 2	2, 3	2, 4	2, 5	2, 6
3	3, 1	3, 2	3, 3	3, 4	3, 5	3, 6
4	4, 1	4, 2	4, 3	4, 4	4, 5	4, 6
5	5, 1	5, 2	5, 3	5, 4	5, 5	5, 6
6	6, 1	6, 2	6, 3	6, 4	6, 5	6, 6

10 out of the 36 possible outcomes add up to 9 or more, so the probability is $\frac{5}{18}$

Go back to the coins.

Remember there were 4 possible outcomes if I toss 2 coins

Heads, Heads		**H H**
Heads, Tails	or	**H T**
Tails, Heads		**T H**
Tails,Tails		**T T**

There are 4 possible outcomes because 2 x 2 = 4, just as for two dice there are 36 possible outcomes because 6 x 6 = 36

If I toss three coins, what are the possible combinations?

T T T – 0 Heads (3 Tails)

H T T
T H T
T T H
– 1 Head (2 Tails)

H H T
H T H
T H H
– 2 Heads (1 Tail)

H H H – 3 Heads

There are 8 possible outcomes because 2 x 2 x 2 = 8

If I toss three coins, what are the possible combinations?

T T T – 0 Heads (3 Tails)

The probability of 0 Heads is $\frac{1}{8}$

H T T
T H T
T T H

1 Head (2 Tails)

The probability of 1 Head is $\frac{3}{8}$

H H T
H T H
T H H

2 Heads (1 Tail)

The probability of 2 Heads is $\frac{3}{8}$

H H H – 3 Heads

The probability of 3 Heads is $\frac{1}{8}$

If I toss three coins, what are the possible combinations?

H H H – 3 Heads

The probability of 3 Heads is $\frac{1}{8}$

H H T
H T H
T H H
– 2 Heads (1 Tail)

The probability of 2 Heads is $\frac{3}{8}$

H T T
T H T
T T H
– 1 Head (2 Tails)

The probability of 1 Head is $\frac{3}{8}$

T T T – 0 Heads (3 Tails)

The probability of 0 Heads is $\frac{1}{8}$

Simulation Hyperlink