

The probability

Which side the first ball will fall down? To the left (0) or to the right (I)?



Fig.1 – the fair conditions

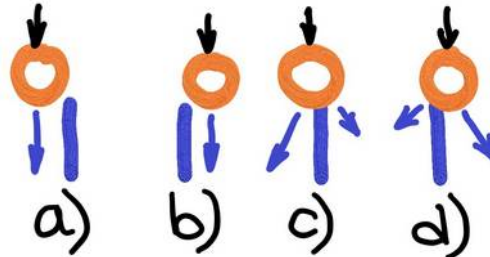


Fig.2 – the unfair conditions

In fair conditions we don't know in every case in which side the ball will fall down.

In unfair conditions :

- a) the ball always fall down to the left
- b) the balls always fall down the right
- c) the ball mostly fall down to the left
- d) the ball mostly fall down to the right

In fair conditions we use the probability. In our case (Fig.1) there are two events – left (0) or right (I) for one experiment. Events are independent to each other. The two events which could be realized are called possible outcomes (**A**). When the experiment (or a trial) is over - one event which has been realised is called a favourable outcome (**n**). The equation for the probability (**P**) of one event (an outcome or set of outcomes) is the ratio of favourable (**n**) to possible outcomes (**A**).

$$P = \frac{n}{A} \quad \text{Eq. 1}$$

0000	0I00	I000	II00
000I	0I0I	I00I	II0I
00I0	0IIO	I0I0	IIIO
00II	0III	I0II	IIII

Tab. 1 – the possible outcomes (marked bold) for an experiment in which a coin is tossed four times (or for the experiment with four balls – see Fig.1), I is a head and 0 is a tail

Solve the Probability **P** for table 1 – we know the possible outcomes **A = 16** , where the favourable outcomes (at least three heads are obtained) **n = 4**

then

$$P = \frac{4}{16} = \frac{1}{4} \quad \text{Eq. 2}$$

if favourable outcome is $n = 1$ (four heads – **I**) against to possible outcomes **A = 16**
then

$$P = \frac{1}{16}$$

Eq. 3

How many trials with coin we must do there to get the progress **IIII** inside a long list of possible outcomes. We must do 16 trials. Really? Are there all possible outcomes? Or there is another number of trials? Prove it!

16 trials means such progress of outcomes: **0,I,I,0,0,0,I,I,I,0,I,0,0,0,I,0**

There are not of all possible outcomes. All possible outcomes are written in tab. 1? I believe we must do $16 \times 4 = 64$. We must do 64 trials (or 16 sets with 4 trials inside it) to have a big chance for the pure progress **IIII**.

See more

$$2^4 * 4 = 64$$

Eq.4

The number 2 means the two sides of the coin. The number 4 means the number of positions in a binary code (e.g. 000I).

For a polyhedron with 16 sides marked at every side with **0000, 000I, ..., IIII, IIII** we must do really only 16 trials to get the side with . Go on. For N-hedron with N-sides marked from 00000.....0, 00000.....I, , IIII.....I we must do N trials to obtain one of N-sides. Go on. If N is close to infinity. Then we obtain an ideal ball with infinity points. How many trials we must do? Infinity? Which kind of infinity?

$$P = \frac{1}{\infty}$$

Eq. 5

What does it mean the number 1? One point of the surface of the ball? Remember infinitesimals. We could go closer to zero (0).

The real probability in our universe - we need a dimension.

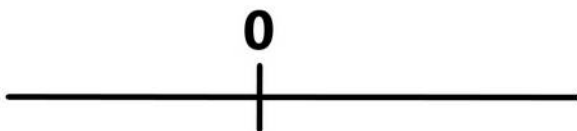


Fig. 3 – one event with a zero length to a line with an infinity length

The Probability

$$P = \frac{0}{\infty}$$

Eq. 6

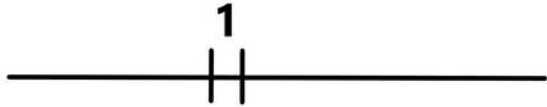


Fig. 4 – one event with a per unit length to a line with an infinity length

The probability

$$P = \frac{1}{\infty}$$

Eq. 7

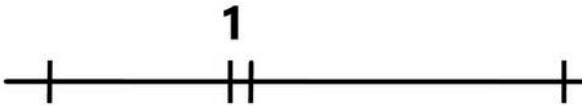


Fig. 5 – one event with a per unit length to a line with a dimension 24 unit length

The probability

$$P = \frac{1}{24}$$

Eq. 8

Now, we are able to solve the probability cases. We have a dimension of one event and we have a dimension of all events, either.

Is it possible to get the favourable progress of outcomes **IIIIIIIIII** – for 10 trials with the ball - to fall down only to one side? Or 100 times to get only 0? Or more?

It depends how many balls we put down. We have only one edge. The first ball went down by the right side – **I**. We expect the second one have to go down to the left side. It's only our imagination. In fact - the probability is the same for the second ball! And for the next ball until one hundred millions balls. The probability is fixed at $\frac{1}{2}$. Nothing else. If the ball went down for six hundred times to the left there is no mark why the probability could change.

Explain this by using of the next figure.

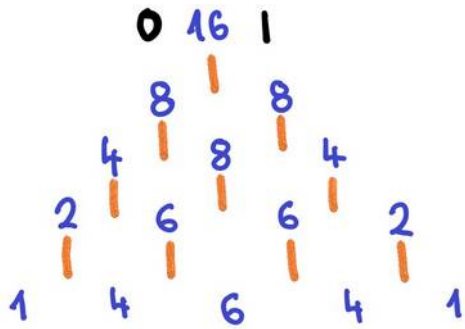


Fig. 6 – 16 balls with 4 rows with edges

The distribution of balls is arranged in the fig. 6. If the conditions are fair. Every portion of balls must be divided to the half on every edge. Only one ball went only to the right through 4 rows with edges. Because there is only one path, instead of the middle part, where is 6 paths.

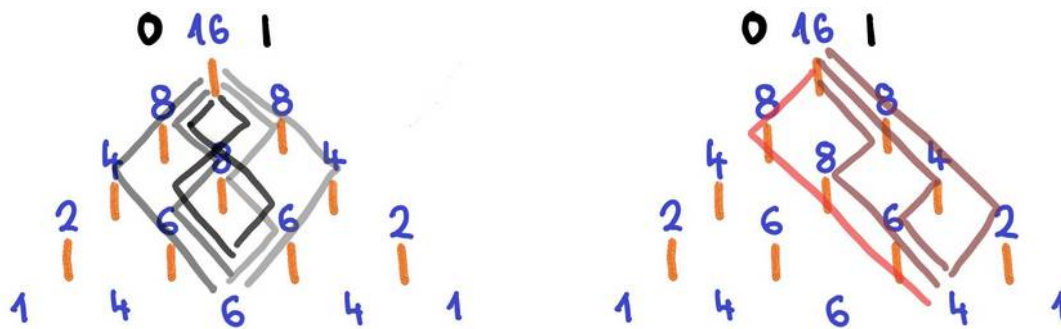


Fig. 7 – 6 paths from the top

Fig. 7 – 4 paths from the top to each side

We replace the concrete number of balls in the top by a number 1 then we get the following distribution

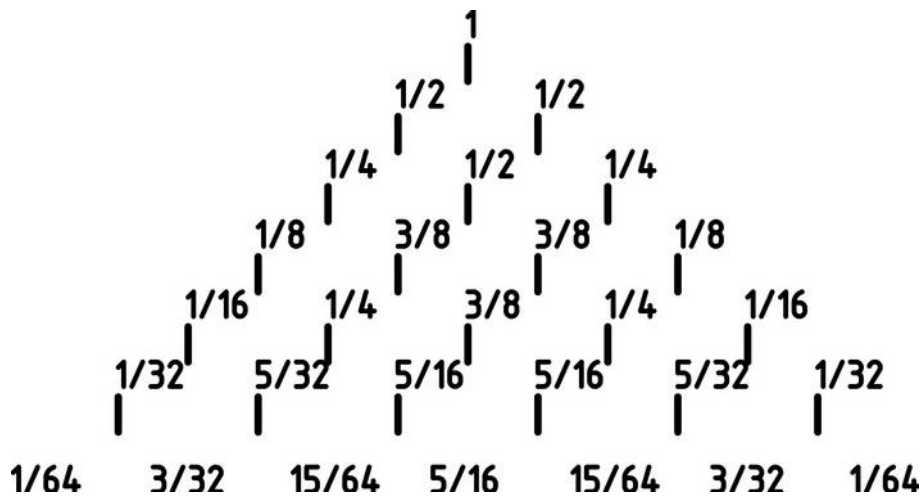


Fig. 8 – 1 ball on the top edge with 6 rows

