



PROBLÈME DES PARTIES

Louis XIV (1643 - 1715), le roi soleil, is the embodiment of the absolute ruler. He had built the palace of Versailles.



Probability Calculus is considered to be born in 1654 when Chevalier de Méré, a man of letters and a notorious gambler at the court of Louis XIV, turned to the famous mathematician and philosopher Blaise Pascal with two problems. One of them was how to divide the stakes at a game when it had to be interrupted, now known as "Problème des parties".

Two players put the same amount of money at stake and then toss a coin. If it shows a "head" player A gets a point, if it shows a "tail" player B gets a point. The first one with 5 points will win all the money.

After 7 games with player A having 4 points and player B having 3 points the game is broken off.

How can the money be divided fairly?

In his letter to Pascal De Méré made two suggestions:

Following the ratio of the won games, i.e. 4 : 3, or following the inverse ratio of the still missing wins, i.e. 2 : 1.

Blaise Pascal (1623 - 1762), philosopher, mathematician and physicist. He showed by experiments that the air pressure depends on the height above ground. The higher up you climb the lower is the air pressure. (Unit for pressure is $\text{Pa} = \text{N/m}^2$)

For his father, a public servant, he constructed a calculator that could do the 4 basic operations.



1

Finish the broken off game 20 times, i.e. repeat the following for 20 times:
Give player A 4 and player B 3 points and then toss the coin until one of them has 5 points and note down the result.

What is your suggestion how the money should be divided up?

In the summer of 1654 Pascal started correspondence with Pierre de Fermat to discuss the two questions asked by de Méré. Both mathematicians independently came to the conclusion that both of de Méré's solutions were wrong. Correct would be a division with the ratio 3 : 1.

Pascal's explanation:

He assumes that 64 Louis D'or are at stake. The score is 4:3 in favour of player A. The coin is tossed for the eighth time.

In half of all cases the coin shows a "head", and the game ends with a victory for A. Therefore Pascal gives A 32 Louis D'or.

In all the other cases the coin shows a "tail", and the score is 4:4. Therefore Pascal distributes the remaining 32 Louis D'or equally and gives 16 to each of the players. Finally, player A gets 48 Louis D'or and player B 16 Louis D'or which results in a division of the stake with the ratio **3:1**.

Pierre de Fermat (1601 - 1665), lawyer and mathematician. He occupied himself with mathematics only in his leisure time. Nevertheless he belonged to the outstanding and most productive mathematicians of his era. He used to tease his colleagues by sending them his latest discoveries without a proof. One of them was the now called "Fermat's Last Theorem":

$$x^n + y^n = z^n \quad (n > 2) \quad \text{has no solution.}$$

He claimed to have a proof but it is unlikely that it was correct because only after centuries of research by many famous mathematicians could a correct proof be found by Andrew Wiles (1993).



The "**Louis D'or**" is a gold coin first introduced by King Louis XIII of France in 1640 and replaced the old gold coin "Franc". The name derives from the depiction of the portrait of King Louis on one side of the coin; the French royal coat of arms is on the reverse. The coin was in use until the French Revolution.



2

How should the 64 Louis D'or be distributed if A has got 3 points and B 1 point?