Games of Chance

Throwing the dice and card games were very popular in the Middle Ages. Big state lotteries were used for funding the states, while private lotteries were prohibited, but, of course, could not really be prevented.

One problem in privately performed gambling is known as he division problem and refers to the question how the stake should be divided among the players in case that the game is aborted before its end.

Around 1500, Italian mathematician, among them the physician, mathematician and engineer Girolamo Cardano (1501-1576) ("´cardan shaft") started to deal with the division problem, however, with being able to find general solutions. Cardano writes about games of chance:

> *Even if games of chance are pure devil's work, one must look upon it as natural devil's work because of the large number of people who gamble. Therefore, it is correct of a physician analyzes it, hust as well as he analyzes a cureless illness.*

Galileo Galilei (1564-1642) dealt in "*Sopra le Scoperte dei Dadi*"(= About a discovery concerning dice) with the following problem: In his time the sums 9 and 10 when throwing three dice are looked upon as equivalent with respect to the chance of winning. However, experience contradicted this claim, since it seemed that the sum 10 occurred more frequently. Galilei calculated all possibilities (216) and determined that the number of combinations yielding the sums 9 and 19. He realized that there are 27 different possibilities to obtain 10, but only 25 possibilities to obtain the sum 9.

Cardano and Galilei started the mathematical investigations of game of chance, by approving experiences and answering questions about gainful strategies.

The starting signal for the systematic development of a theory of games of chance was, however, given by Antoine Gombaud, Chevalier de Méré, who formulated a number of problems concerning game of dice and called for their solution. Among the problems were the following:

1. When throwing three dice which sum has the larger chance to appear, 11 or 12?

2. (Division problem): Two players A and B play a number of games where there is no draw and both players have the same chance to win.

> They play for money and the first player who wins five games gets the stake. Because of some reasons the play has to be aborted at a score of 4:3 for A. How should the stake be divided in a fair way?

When the Chevalier de Méré send a letter to Blaise Pascal (1623-1662) asking for a solution, Pascal sent his solution to Pierre de Fermat (1601-1665), which led to the famous "correspondence" between Pascal and Fermat which lasted from July to October 1654. Then it was stopped from the side of Pascal. This correspondence is regarded nowadays as the founding act of probability theory.

Blaise Pascal wrote:

> *By connecting the rigor of mathematics with the uncertainty of randomness, these two obviously contradictory concepts are reconciled and it is justified to use the names of both components so that the startling term "mathematics of randomness" (alea geometria) does not appear to be pretentious.*

From the viewpoint of mathematics, the theory of games of chance constitutes a special application of combinatorics aiming at determining certain 'expectations' which are calculated by means of certain numbers of combination and permutation.