

## Mathematical Expectation

A lottery player's interest is in the prospect of the big win while that of an investor is in the average that can be realized. The big win is a phantom while the investor's average is the robust that has a chance bigger than that of the smallest prize in a lottery.

The most important tool for making intelligent decisions in the face of uncertainty is the concept of "Mathematical Expectation." It helps us to evaluate and compare propositions involving chance. It is like a bottom line figure that can not lie. In lottery it shows what individual ticket holders can mathematically expect and what state governments can count on from participation in a state lottery. It informs the casino what it can make despite the occasional big wins by players. It drives insurance and all manner of hedging. To the extent that it gives a predictable robust percentage, it is an epithet for financial planning in a risk-reward undertaking. Our discussion below applies to lotteries and gambling and hence relates to events with finite number of outcomes with fixed chance.

### 2.1 Mathematical Expectation: The bottom line in gambling

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Consider the 'average' or arithmetic mean of a collection or a set of numbers, with some numbers possibly repeated. For example, the average of the numbers in the set  $\{2, 3, 3, 4, 5, 5, 5\}$  is

$$\frac{2 + 3 + 3 + 4 + 5 + 5 + 5}{7} = \frac{2 \times 1 + 3 \times 2 + 4 \times 1 + 5 \times 3}{7} = \frac{2 + 6 + 4 + 15}{7} = \frac{27}{7}.$$