AVERAGE WINNINGS IN LOTTERY

Suppose in a lottery the first prize is $10,000, there are 5 second prizes $1000 each and 50 third prizes $100 each. (The remaining 9944 people get zero dollars).

So the total payout is 10000+5(1000)+50(100) = 20,000.

If they sold a total of 10,000 tickets each costing $5, then total revenue is 50,000.

So the lottery organizers pocket $30,000.

The **average winnings** per person (or ticket) is 20000/10000 = $2.

A BIT OF PROBABILITY

Probability is really about averages, as you will see below.

Probability of winning first prize, denoted by P(1st) = P(10000) = 1/10000 since only one ticket out of the 10000 gets the 1st prize.

Similarly P(1000) = 5/10000, P(100) = 50/10000 and P(0) = 9944/10000.

The **Expected value E(x)** is defined as the sum of the products of values with their probability. If the values are denoted by x, then E(x) = Sum of x times P(x).

This is simply the average winning, as you can see below:

E(x) = 10000(P(10000)) + 1000(P(1000)) + 100(P(100)) + 0(P(0))
= 10000(1/10000) + 1000(5/10000) + 100(50/10000) + 0(9944/10000)
= 1+ (1/2)+(1/2) = 2.

You can also see that it adds up to 2 if you write the sum as

$$E(x) = \frac{10000 + 5(1000) + 50(100) + 0(9944)}{10000}$$

You see that this is exactly same calculation as the one we did above, for average winnings.