Law of numbers

Law of Large Numbers A The law of large numbers (LLN) explains that as the number of trials increase, the random variable becomes stable in the long-run. If a trial of probable situation is repeated again and again, then the more times the trial is repeated, the more likely it is that the frequency of any particular event will be close to the probability of that event. Condition applied here is of an independent and identically distributed random variable which has a finite population mean and variance. In such a condition it is expected that the average of these observations will approach and stay close to the population mean. [2]

B

If a coin is tossed many times, the more times it is tossed, the likelihood of the number of " heads" in the total population will be close to 1/2. This Law of Large Numbers can be further explained with the help of a Randomly Generated Coin Toss online applet (available from http://hspm. sph. sc. edu/COURSES/J716/a01/stat. html).

The coin is unbiased and it has two sides that are equally likely to come up. When the random generator is run, the applet shows the proportion of heads in the total population. In the first 10 tosses the proportion of heads is 0. 272 (3 heads and 7 tails). When it is run for a longer time up to 100 tosses the proportion of heads approaches one-half and becomes 0. 48 (43 heads and 47 tails). For a 1000 tosses the proportion of heads become 0. 499 (502 heads and 498 tails). This figure will fluctuate around 0. 5, with the fluctuations slowly getting smaller and almost reaching 0. 5. [1]

C

1) Let's say you flipped the coin once and it landed on heads. You will expect that on alternative tosses you will get a head. In 10 coins are tossed you

expect 5 to be heads since the expected percentage of successes is 50%. But in reality only three are heads. The difference between the actual and expected number of successes is 2. The actual percentage of number of heads is 20% meaning a difference between actual and expected percentage of 30%. If the coin is tossed 100 times, you expect 50 heads to come but in reality only 35 heads appear. The difference increases from 2 to 15. However the actual percentage of number of heads is 35% and therefore the difference between actual and expected percentage of successes decrease to 15%.

2) If a coin is tossed a 1000 times, it is extremely likely that we will get the number of heads approximately equal to 500 and thereabouts. The concept of Large Numbers can be applied here to explain this scenario. As mentioned above, as the number of trials increase, the probability of event occurring reaches to an average mean of the population. The probability of a head occurring in a single toss of an unbiased coin is 1/2. When a large numbers of coins are tossed, it is expected that the proportion of heads occurring will remain close to 1/2. So when we find the expected results we multiply the Number of Tosses with the probability of heads on each toss. This comes to be around 500 and not exactly 500 as some variances do occur in randomly generated numbers.

3) The chances of getting a head after 3 consecutive tails is still 50%. This does not change because in an unbiased coin, tails and heads occurring have an equal likelihood of 50%. It is the proportion that changes not the probability.

Works Cited

1. " The Law of Large Numbers", University of South Carolina, Available at ,

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2. Weiss, A. Neil., " Classical Probability", Introductory Statistics, 4th Edition, Addison-Wesly Publishing Company, Singapore, ISBN 0-201-53270-0