Practice Questions 3

1. Give some specific examples where data analytics will be helpful in the following domains: Healthcare, Sports, Financial Markets and Consumer Markets.
2. Suppose a student gets a mark more than his class average. Does it guarantee that he is in the top-half of the class? Explain. (You may try to give some examples and then try to generalize the argument)
3. Discuss the relationship between the Mean and Median in the case of left-skewed and right-skewed distributions with examples for both scenarios.

[Hint: Right Skewed distribution have tail on the right side of the mode of the distribution. Left Skewed distribution have tail on the left side of the mode of the distribution.]

1. A weighted coin, its probability of landing on heads is 20%. Suppose that the coin is been flipped 20 times. Find a bound for the probability it lands on heads at least 16 times.



**Markov Inequality: If X be a random variable that takes only non-negative values. Then for any positive real number a, Probability, where E[X] is mean of the random variable.**

1. Suppose a fair coin is flipped 100 times. Find a bound on the probability that the number of times the coin lands on heads is either less than 40 or more than 60.

[ Hint: Here Probability distribution of X follows Binomial distribution with mean 50 and variance 25, Use Chebyshev Inequality]

**Chebyshev Inequality: Let X be any random variable with finite expected value and variance. Then for every positive real number a, Probability**

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Sol 5: P(X<40 U X>60)=P(|X-E[X]≥10)=Var(X)/10^2=25/100=0.25.

1. A biased coin lands heads with probability1/10. This coin is flipped 200 times. Use Markov's inequality to give an upper bound on the probability that the coin lands heads at least 120 times. Improve this bound using Chebyshev's inequality.
2. The average height of a raccoon is 10 inches.
   1. Given an upper bound on the probability that a certain raccoon is at least 15 inches tall.
   2. The standard deviation this height distribution is 2 inches. Find a lower bound on the probability that a certain raccoon is between 5 and 15 inches tall.
3. Suppose the average height of male adults in Jaipur is 165 cm and the SD is 10. What portion of male adults would be of height less than 190 cm? Use both Markov and Chebyshev's inequality.
4. Consider a Normal Distribution. Use Chebyshev's inequality and find how much portion of the population (In terms of percentage) would be in the following ranges: μ±σ, μ±2σ, and μ±3σ. Where E[X]=µ and Var(X)=σ^2.
5. Draw a sample from a normal distributed population with mean is μ and SD is σ. Take a sample of size *n* from the population. Calculate the mean of the sample. Repeat the sampling and calculate the mean  for considerably large number of times. What is the probability distribution of  and what is the mean will be μ and SD of the distribution? [Hint: Central Limit Theorem]