THEORY:

True IQ of Person “A” is 90

True IQ of Person “B” is 110

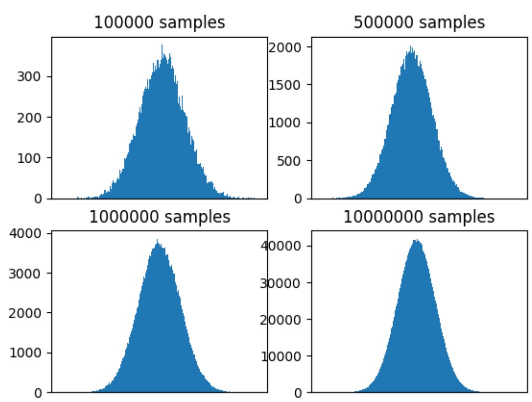
Due to the External Factors the Recordings of IQ is not accurate instead it is distributed “Normally” where the Probability Density Function is given by,

PDF = $\frac{1}{\sigma(2\,\pi)^{0.5}}\,e^{\frac{-(x-\mu)^2}{2\,\sigma^2}}$

μ = mean of the normal distribution

σ = standard deviation of the normal distribution

The reason to use Monte Carlo method for Gaussian Distribution is to model the probability of different outcomes in a process that cannot easily be predicted due to the intervention of random variables. This method is used wherever the number of factors affecting the probability are large and all are taken account. An Example for why more the data size, better the results.



The problem is to find the Expected value of the Second recording of the IQ value of randomly chosen person (A or B) where the first recording is 105.

Probability that the person chosen is A, for example,knowing that the IQ recorded is 105 would be equal to,

P(A| IQ=105) = $\frac{P(\text{IQ=105}\mid A) * P(A)}{P(\text{IQ=105}\mid A) * P(A) + P(\text{IQ=105}\mid B) * P(B)}$

Finally, to find the expected value of second reading, we have to take the weighted average of the IQ.

E(second) = 90 * P(A | IQ = 105) + 110 * P(B | IQ = 105)

The same can be extrapolated to the crowd of very large number where the mean IQ is μ_T, Standard deviation is σ_T, Standard deviation of the person chosen is σ and the IQ of first recording is x.From the fact that the True IQ of a person is independent of the error variables and mean of error is zero the expected value of the second recording is, $E[T \mid T + E = x] = \mu_T * \frac{1}{1+\left(\frac{\sigma_T}{\sigma}\right)^2} + x * \frac{\left(\frac{\sigma_T}{\sigma}\right)^2}{1+\left(\frac{\sigma_T}{\sigma}\right)^2} = v$

$\left(\frac{\sigma_T}{\sigma}\right)^2 > 0$ and $x > \mu_T$ (Given). We can easily prove that the value v lies between μ_T and x. This can be done using section formula where v is dividing μ_T and x by ratio $\left(\frac{\sigma_T}{\sigma}\right)^2 : 1$. The important take-away from this is that as the number of iterations increases, the expectation value regresses to the mean value which is very important study under statistics and probability.