Assignment 1

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Download all python codes from

https://github.com/SAHIL150602/AI1103/blob/main/Assignment1/codes/Assignment.py

and latex-tikz codes from

https://github.com/SAHIL150602/AI1103/blob/main/Assignment1/Assignment1.tex

1 Problem

How many times a man must toss a coin such that the probability of getting atleast one head is greater than 90%

2 Solution

The probability of getting heads when an unbiased coin is tossed 1 time is $\frac{1}{2}$.

Similar for tails

By Binomial distribution the probability of getting k heads is

$$\begin{aligned} P(X=k) &= {}^{n}C_{k}\left(\frac{1}{2}\right)^{k}\left(\frac{1}{2}\right)^{n-k} \\ &= \frac{{}^{n}C_{k}}{2^{n}} \end{aligned} \tag{1}$$

So the probability of getting atleast one head is $P(X>0)$.

By binomial distribution we also know that

$$\sum_{i=0}^{n} P(X=i) = 1$$

So $$Prob + P(X=0) = 1$$

$$Ans = 1 - P(X=0)$$

$$= 1 - \frac{{}^{n}C_{0}}{2^{n}}$$

$$Prob = 1 - \frac{1}{2^{n}}$$

the condition given was probability of getting at least one head must be greater than 90%

$$\implies Prob > 0.9$$

$$\implies 1 - \frac{1}{2^{n}} > 0.9$$

$$\implies \frac{1}{2^{n}} < 0.1$$

$$\implies 2^{n} > 10$$

Hence $n = 4$

$\implies$ The minimum number of times the coin has to be tossed so that the probability of getting atleast one head is greater than 0.9 is 4 times.