Assignment 1

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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

$$P(X = k) = {}^nC_k \left(\frac{1}{2}\right)^k \left(\frac{1}{2}\right)^{n-k}$$

$$= \frac{{}^nC_k}{2^n}$$

So the probability of getting atleast one head is

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

,some variable. By binomial distribution we also know that

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

So $\qquad Ans + P(X = 0) = 1$

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

$$= 1 - \frac{{}^nC_0}{2^n}$$

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

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

$$\Rightarrow Ans > 0.9$$

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

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

$$\Rightarrow 2^n > 10$$

Hence $n = 4$

$$\Rightarrow$$

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.