Assignment 3 -Probability and Random Variable

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I. PROBLEM STATEMENT-PROBLEM 3.10

How many times must a man toss a fair coin so that the probability of having at least one head is more than 90

II. SOLUTIONS

Let r be the number for getting no. of heads.
let n =total no. of times a coin is tossed
therefore, q=1-p ,which is probability of getting a tail.Since it is the case of fair coin, therefore p=0.5 and q =0.5

$$p = \frac{1}{2} \tag{1}$$

$$q = 1 - \frac{1}{2} = \frac{1}{2} \tag{2}$$

From bernaulli's distribution, we know

$$Pr(X = r) = {}^{n}C_r p^r q^{n-r} \tag{3}$$

$$X \sim Bin(n, p = 0.5) \tag{4}$$

We are required to find the number of trials such that the sample probability of having at least one head is more than 90

$$Pr(X \geq 1) = 1 - Pr(X = 0) \tag{5}$$

$$= 1 - {}^{n}C_0 0.5^0 0.5^{n-0} > 0.9 \tag{6}$$

$$= 1 - (\frac{1}{2})^n > 0.9 \tag{7}$$

$$= (\frac{1}{2})^n < 0.1 \tag{8}$$

$$= 2^n > 10 \tag{9}$$

This implies n $\geq$ 4

Therefore, the required number of trials must be greater than or equal to 4

Hence the desired number of trials is n$\geq$ 4