Assignment 4-Probability and Random Variable

Annu-EE21RESCH01010

Download latex code from here-

https://github.com/annu100/AI5002−Probability−and−Random−variables/tree/main/ASSIGNMENT_4

download python code from here

https://github.com/annu100/AI5002−Probability−and−Random−variables/blob/main/ASSIGNMENT_4/assignment_4.py

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%

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

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

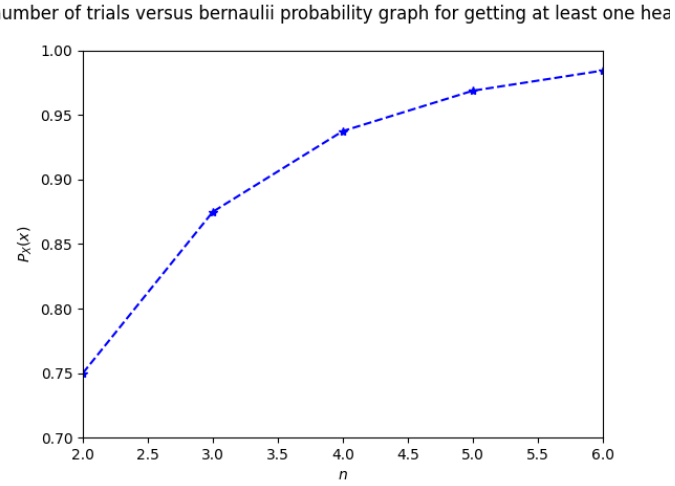
$$= 1 - (\frac{1}{2})^{n} > 0.9 \tag{7}$$

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

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

This implies $n \geq 4$

Therefore, the required number of trials must be greater than or equal to 4.From graph,we can also see



Above is is the graph of no. of trails versus probability