Probability&RV Assignment-10

Anuradha U-ee21resch01008

Download Latex code from

https://github.com/Anuradha−Uggi/Assignments−AI5002−Probability−and−Random−Variables/blob/main/Prob_ass10/rvsp_10.tex

Download Python code from

https://github.com/Anuradha−Uggi/Assignments−AI5002−Probability−and−Random−Variables/blob/main/Prob_ass10/rvsp_10.py

I. QUESTION(GATE-Q18)

A fair coin is tossed till a head appears for the first time.the probability that the number of required tosses is odd,is..

1) $\frac{1}{3}$

2) $\frac{1}{2}$

3) $\frac{2}{3}$

4) $\frac{3}{4}$

II. SOLUTION

Let X be the random variable represents odd number of tosses to get first Head.
possibilities are

X	1	3	5	7 ...
P(X)	$\frac{1}{2}$	$(\frac{1}{2})^3$	$(\frac{1}{2})^5$	$(\frac{1}{2})^7$...

probability of odd tosses for first head can be computed as

$$P(X) = \frac{1}{2} + (\frac{1}{2})^3 + (\frac{1}{2})^5 + (\frac{1}{2})^7 + ... \quad (1)$$

we can observe that above series is a Geometric Series so the sum of infinite terms in Geometric Series can be computed as

$$Sum = \frac{FirstTerm}{1 - CommonRatio} \quad (2)$$

from equation (2)

$$P(X) = \frac{0.5}{1 - 0.5^2} = \frac{2}{3} \quad (3)$$

similarly for even number of tosses getting first head can be computed as below

$$X = 2, 4, 6, ... \quad (4)$$

$$P(X) = (\frac{1}{2})^2 + (\frac{1}{2})^4 + (\frac{1}{2})^6.... \quad (5)$$

$$P(X) = \frac{0.5^2}{1 - 0.5^2} = \frac{1}{3} \quad (6)$$

III. CONCLUSION

Correct Option is : 3