Probability&RV Assignment-02

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download Python code from

https://github.com/Anuradha−Uggi/Assignments−AI5002−Probability−and−Random−Variables/blob/main/Prob_ass02/PmfRvsp.py

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I. QUESTION(1.12)

A coin is biased so that the head is 3 times as likely to occur as tail.if the coin is tossed twice,find the probability distribution of number of tails.

II. SOLUTION

Given that the coin is biased.when coin is tossed once then Probability of occurrence of Head is = 3 times the occurrence of tail.Lets assume that the possible outcomes of a coin toss are random in nature and its represented by a random variable y.where
$y = 0$ is the outcome of occurrence of Head and $y = 1$ is the outcome of occurrence of Tail.then

$$P(y = 0) = 3P(y = 1) \tag{1}$$

when the coin is tossed twice then the possible outcomes are $00, 01, 10, 11$.
as the coin is biased

$$P(y = 0) = \frac{3}{4}$$

$$P(y = 1) = \frac{1}{4}$$

$X = 0$ represents no tails i.e both are heads
$X = 1$ represents 1 tail and other is head
$X = 2$ represents 2 tails and no heads
Let X represents number of Tails and P(X) represents the distribution of X which can be expressed as

X	0	1	2
P(X)	$\frac{3}{4} \times \frac{3}{4}$	$\frac{3}{4} \times \frac{1}{4}$	$\frac{1}{4} \times \frac{1}{4}$

let

$$P(y = 0) = P = \frac{3}{4}$$

$$P(y = 1) = 1 - P = \frac{1}{4}$$

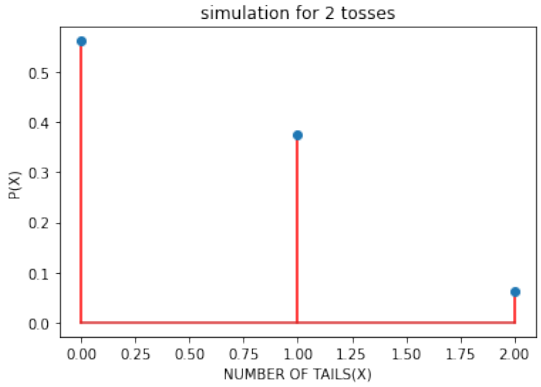
Generalization over such coin toss event for outcome of Number of Tails in this case can be achieved using Binomial Distribution as

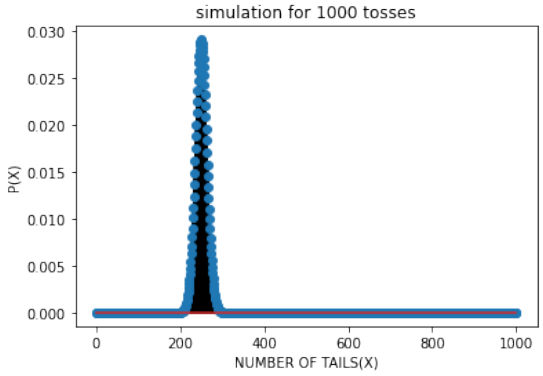
$$P_x = \binom{n}{x} P^x (1 - P)^{n-x}$$

where x is a random variable that defines Number of possible Tails in the event.and it can take values from 0 to n.

III. CONCLUSION

Probability Distribution of Number of Tails is obtained as below.


simulation for 2 tosses
P(X)
0.0
0.1
0.2
0.3
0.4
0.5
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
NUMBER OF TAILS(X)


simulation for 1000 tosses
P(X)
0.000
0.005
0.010
0.015
0.020
0.025
0.030
0
200
400
600
800
1000
NUMBER OF TAILS(X)