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

I. QUESTION

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

- Probability of occurrence of Head is = 3 times the occurrence of tail.
- Let Y is a random variable takes values 0 and 1.
- $Y = 0$ is the outcome of occurrence of Head.
- $Y = 1$ 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

$$P(Y = 0) = \frac{3}{4} \tag{2}$$

$$P(Y = 1) = \frac{1}{4} \tag{3}$$

- $X = 0$ 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.

where X represents number of Tails and P(X) represents the distribution of X.

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

$$P(Y = 0) = q = \frac{3}{4} \tag{4}$$

$$P(Y = 1) = 1 - q = \frac{1}{4} \tag{5}$$

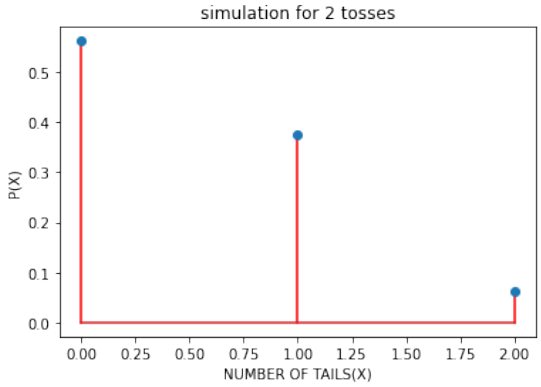
Generalization over such coin toss event can be obtained using Binomial Distribution as

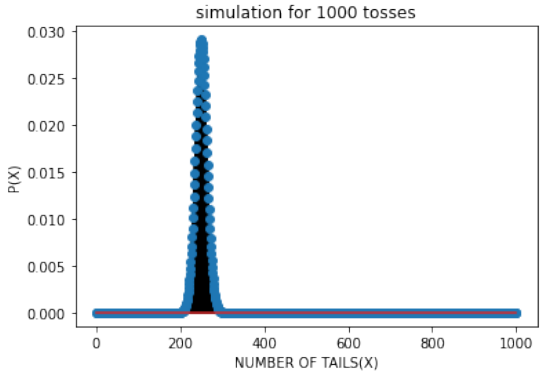
$$P(X = k) = \binom{n}{k} q^k (1 - q)^{n-k} \tag{6}$$

where k is a discrete variable 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)