AI1103-Assignment 1

Name: badavathu revanth, Roll Number: CS20BTECH11007

Download all python codes from

```
https://github.com/cs20btech11007/assignment1/blob/main/
    assignment1/code/assignment1.py
```

and latex-tikz codes from

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https://github.com/cs20btech11007/assignment1/blob/main/
    assignment1/main.tex
```

Problem 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.

sol.

In the question given that,coin is biased and head is 3 times as likely to occur as tail. The coin has tossed twice let X be random varaible X$\in \{0, 1, 2\}$ denotes outcomes in a experiment showing number of tails.
$P(X)_h$ denotes the out come is head.
$P(X)_t$ denotes the out come is tail .
Given that,

$$P(X)_h = 3P(X)_t \tag{0.0.1}$$

and we know that,

$$P(X)_h + P(X)_t = 1 \tag{0.0.2}$$

substitute in eqn (1)

$$P(X)_h = 3P(X)_i$$
$$P(X)_t + 3P(X)_t = 1$$
$$4P(X)_t = 1$$
$$P(X)_t = \frac{1}{4}$$

and

$$P(X)_h = \frac{3}{4}$$

.

using binomial distribution and now finding probability distribution of number of tails in the events.

$$\Pr(X = k)_t = \begin{cases} {}^nC_k p^k (1-p)^{n-k} & \\ & 0 \le k \le n \\ 0 & otherwise \end{cases} \tag{0.0.3}$$

$$\Pr(X = k)_t = {}^nC_k(\frac{1}{4})^n(1 - \frac{1}{4})^{n-k} \tag{0.0.4}$$

$Pr(X = 0)_t$ denotes the " 0 " number of times the coins showed tail in 2 tosses.

$$\Pr(X = 0)_t = {}^2C_0\left(\frac{1}{4}^0\right)\left(1 - \frac{1}{4}\right)^2 = \left(\frac{3.3}{4.4}\right) = \frac{9}{16} \tag{0.0.5}$$
$$\implies \Pr(X = 0)_t = 0.5625$$

$Pr(X = 1)_t$ denotes the " 1 " number of times the coins showed tail in 2 tosses.

$$\Pr(X = 1)_t = {}^2C_1\left(\frac{1}{4}\right)^1\left(1 - \frac{1}{4}\right)^1 = (2)\left(\frac{1.3}{4.4}\right) = \frac{6}{16} \tag{0.0.6}$$
$$\implies \Pr(X = 1)_t = 0.375$$

$Pr(X = 2)_t$ denotes the " 2 " number of times the coins showed tail in 2 tosses.

$$\Pr(X = 2)_t = {}^2C_2\left(\frac{1}{4}\right)^2\left(1 - \frac{1}{4}\right)^0 = \left(\frac{1.1}{4.4}\right) = \frac{1}{16} \tag{0.0.7}$$
$$\implies \Pr(X = 2)_t = 0.0625$$

X	$\Pr(X = k)_t$
0	$\Pr(X = 0)_t$ =0.5625
1	$\Pr(X = 1)_t$ =0.375
2	$\Pr(X = 2)_t$ =0.0625

TABLE 0: Outcome of the Experiment