Assignment 3 9th Class Stats

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```
https://github.com/GunjitMittal/Assignment3/tree/
    main/Assignment3/codes
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```

1 Question

Three coins were tossed 30 times simultaneously. Each time the number of heads occurring was noted down as follows:

0	1	2	2	1	2	3	1	3	0
1	3	1	1	2	2	0	1	2	1
3	0	0	1	1	2	3	2	2	0

TABLE 1.1

Prepare a frequency distribution table for the data given above.

2 Solution

Solution: Counting, we can see that in 30 throws we got 6 throws with no heads, 10 throws with 1 head, 9 throws with 2 heads and 5 throws with 3 heads

No. of Heads	Frequency
0	6
1	10
2	9
3	5
Total	30

TABLE 2.1

Let the random variable $X \in \{0, 1, 2, 3\}$ denote the number of heads in the coin-tossing experiment. Now,

$$\Pr(X = i) = \frac{n(X = i)}{\sum_{i=0}^{3} n(X = i)} \tag{2.1}$$

where $i \in \{0, 1, 2, 3\}$ and n(X = i) is the frequency of getting i heads. Also,

$$\text{Number of times 3 coins were tossed} = 30 \tag{2.2}$$

$$\implies \sum_{i=0}^{3} n(X = i) = 30 \tag{2.3}$$

We have,

$$\Pr(X = 0) = \frac{6}{30} = 0.20 \tag{2.4}$$

$$\Pr(X = 1) = \frac{10}{30} = 0.33 \tag{2.5}$$

$$\Pr(X = 2) = \frac{9}{30} = 0.30 \tag{2.6}$$

$$\Pr(X = 3) = \frac{5}{30} = 0.17 \tag{2.7}$$

Now considering fair coins: Let probability of getting a head be a success and equal to p and probability of getting a tail be a failure and equal to q where $p + q = 1$. We can express this as a binomial distribution

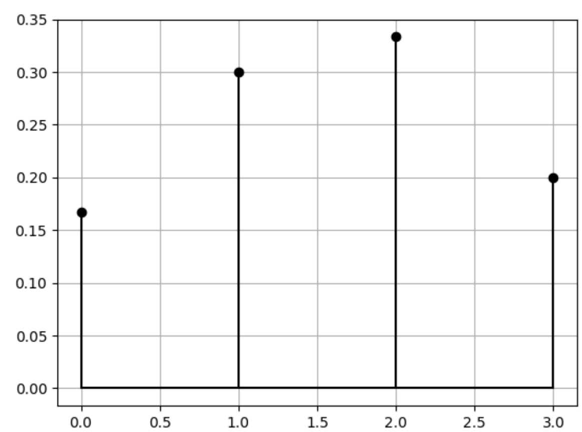

Fig. 2.1. Plot of PMF using above data

$$\sum_{i=0}^{n} \Pr(X = i) = \sum_{i=0}^{n} {}^{n}C_i (\mathrm{p})^i (1 - \mathrm{p})^{n-i} \tag{2.8}$$

where $n = 3$ for 3 coins. Therefore,

$$\Pr(X = i) = {}^{3}C_i (\mathrm{p})^i (\mathrm{q})^{3-i} \tag{2.9}$$

For fair coins,

$$p = \frac{1}{2} \tag{2.10}$$

$$\therefore q = \frac{1}{2} \tag{2.11}$$

Therefore,

$$\Pr\left(X = 0\right) = {}^3C_0 \left(\frac{1}{2}\right)^0 \left(\frac{1}{2}\right)^3 = \frac{1}{8} \tag{2.12}$$

$$\Pr\left(X = 1\right) = {}^3C_1 \left(\frac{1}{2}\right)^1 \left(\frac{1}{2}\right)^2 = \frac{3}{8} \tag{2.13}$$

$$\Pr\left(X = 2\right) = {}^3C_2 \left(\frac{1}{2}\right)^2 \left(\frac{1}{2}\right)^1 = \frac{3}{8} \tag{2.14}$$

$$\Pr\left(X = 3\right) = {}^3C_3 \left(\frac{1}{2}\right)^3 \left(\frac{1}{2}\right)^0 = \frac{1}{8} \tag{2.15}$$

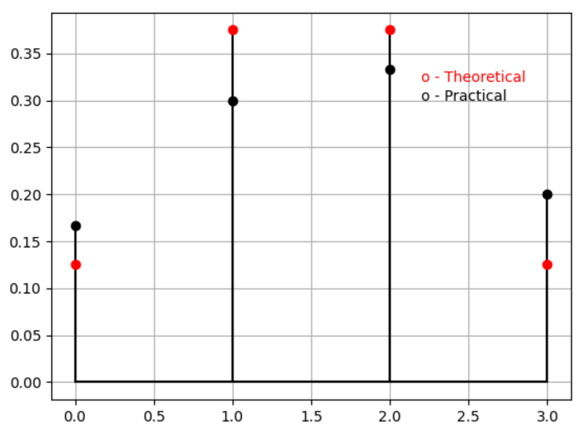

Fig. 2.2. Comparison of theoretical and practical PMF plots