# Probability Assignment-III

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### I. PROBLEM

Find the mean number of heads in three tosses of a fair coin.

### II. SOLUTION

Consider each trial results in success (i.e Heads) or failure (i.e Tails).

Let p and q = (1 - p) be the probability of success and failure respectively.

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

$$q = 1 - p = \frac{1}{2} \tag{2}$$

In n Bernoulli trials with x success and (n - x) failures, the probablity of x success in n- Bernoulli trials can be given as

$$^{n}C_{x}p^{x}q^{n-x} \tag{3}$$

Now the distribution of number of successes using $(1), (2)\&(3)$ can be given as,

| X | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| P(X) | $^{3}C_{0}(\frac{1}{2})^{3}$ | $^{3}C_{1}(\frac{1}{2})^{3}$ | $^{3}C_{2}(\frac{1}{2})^{3}$ | $^{3}C_{3}(\frac{1}{2})^{3}$ |

$$\text{Mean of X} = \mu = \sum_{i=1}^{n=3} x_i P(x_i) \tag{4}$$

$$\mu = 0 \times{}^{3}C_{0}(\frac{1}{2})^{3} + 1 \times{}^{3}C_{1}(\frac{1}{2})^{3} + 2 \times{}^{3}C_{2}(\frac{1}{2})^{3}$$
$$+ 3 \times{}^{3}C_{3}(\frac{1}{2})^{3} \tag{5}$$

$$\therefore \text{Mean of X} = \mu = 1.5 \tag{6}$$