Assignment 10

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Outline

- Question
- 2 Theory
- Solution
- Result



Example 34

Find the mean of the binomial distribution B $\left(4, \frac{1}{3}\right)$



Theory

A binomial distribution with n- Bernoulli trials and probability of success in each trial as p , is denoted by B (n,p)

The probability of k successes Pr(X = k) is also denoted by P(k) and is given by

$$\Pr(X = k) = {}^{n}C_{k}p^{k}(1-p)^{n-k}$$
(1)

for x = 0, 1, 2, ..., n - 1, n



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Mean

$$\mu = \sum_{i=1}^{n} x_i P(x_i) \tag{2}$$

$$\mu = \sum_{r=1}^{n} r \times {}^{n}C_{r}p^{r} (1-p)^{n-r}$$
(3)

$$\mu = (1-p)^n \sum_{r=1}^n r \times {}^n C_r \left(\frac{p}{1-p}\right)^r \tag{4}$$

$$\mu = (1 - p)^n \frac{np}{(1 - p)^n} \tag{5}$$

$$\mu = np$$
 (6)



Solution

Let X be the random variable whose probability distribution is B $\left(4,\frac{1}{3}\right)$. So, we can write that,

$$n=4 (7)$$

$$p = \frac{1}{3}$$

$$q = 1 - p = \frac{2}{3}$$
(8)

$$q = 1 - p = \frac{2}{3} \tag{9}$$

From (1) we can say,

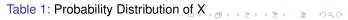
$$\Pr(X = k) = {}^{4}C_{k} \left(\frac{1}{3}\right)^{k} \left(\frac{2}{3}\right)^{4-k}$$
 (10)

for k = 0, 1, 2, 3, 4



Distribution of X

| Xi | $P(x_i)$ | $x_i P(x_i)$ |
|----|---|---|
| 0 | $^4C_0\left(\frac{1}{3}\right)^0\left(\frac{2}{3}\right)^4$ | 0 |
| 1 | ${}^4C_1\left(\frac{1}{3}\right)^1\left(\frac{2}{3}\right)^3$ | ${}^4C_1\left(\frac{1}{3}\right)^1\left(\frac{2}{3}\right)^3$ |
| 2 | ${}^4C_2\left(\frac{1}{3}\right)^2\left(\frac{2}{3}\right)^2$ | $2\left(^{4}C_{2}\left(\frac{1}{3}\right)^{2}\left(\frac{2}{3}\right)^{2}\right)$ |
| 3 | $^4C_3\left(\frac{1}{3}\right)^3\left(\frac{2}{3}\right)^1$ | $3\left(^4C_3\left(\frac{1}{3}\right)^3\left(\frac{2}{3}\right)^1\right)$ |
| 4 | ${}^{4}C_{4}\left(\frac{1}{3}\right)^{4}\left(\frac{2}{3}\right)^{0}$ | $4\left({}^4C_4\left(\frac{1}{3}\right)^4\left(\frac{2}{3}\right)^0\right)$ |



Dasari SrinithAssignment 10May 23, 20227/9

Mean (μ)

We know that, from (6)

$$\mu = np \tag{11}$$

$$\mu = \frac{4}{3} \tag{12}$$



Result

The mean of the binomial distribution B $\left(4, \frac{1}{3}\right) = \frac{4}{3}$

