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The Bionomial Probablity Distribution

If chances of occurance of an event in an experiment is P and no chance to occur that event is q, then in n independent experiments x chance of occurance of an event is

$$P(x^n) = {}^nC_x p^x q^{n-x}$$

Probablity distribution given by above equation is Called Binomial distribution.

Value of x in above equation is 0, 1, 2, 3 .... n then

$p(1)$ = chances of one success of probability
$= {}^nC_1 p^1 q^{n-1}$

$P(2)$ = chances of two success of probability
$= {}^nC_2 p^2 q^{n-2}$

$P(3)$ = chances of three success probablity
$= {}^nC_3 p^3 q^{n-3}$

$P(r)$ = Chances of r success probability
$= {}^nC_r p^r q^{n-r}$ etc.

It means these probability have been taken by the expression of $(q+p)^n$ in serial steps.

$$(q+p)^n = q^n + {}^nC_1 pq^{n-1} + {}^nC_2 p^2 q^{n-2} + \ldots + {}^nC_n p^n$$

If N set is there and in each set there is n attempt then relative frequency can be given by following steps of expansion.

$$N(q+p)^n = N[q^n + {}^nC_1 pq^{n-1} + {}^nC_2 p^2 q^{n-2} + \dots {}^nC_n p^n]$$

Where 0, 1, 2, 3 ..... n success is as per set no is Nq^n, $N. {}^nC_1 pq^{n-1}$, $N. {}^nC_2 p^2 q^{n-2} \dots N. {}^nC_n p$.

Example: In following table r = no. of occurrence of event and f = relative frequency. We have to detect whether distribution is Bionomial or not and what is its mean and standard deviation(σ).

r	0	1	2	3	4	5	6
f	729	1458	1215	540	135	18	1
	0	1458	2430	1620	540	90	6

$$\Sigma x f = 6144$$

$$\Sigma f = 4096$$

Calculation. Here $q^6 \propto 729$ and $q^6 \propto 1$

$$\therefore \frac{p}{q} = \frac{1}{(729)^{1.6}} = \frac{1}{3} = 3p = q = 1 - p$$

$\Rightarrow \quad 4p = 1$

$\therefore \quad p = \frac{1}{4}$ and $q = \frac{3}{4}$

This indicates that the distribution is bionomial in which

$p = \frac{1}{4}$ and $q = \frac{3}{4}$ and $n = 6$

Therefore mean $= np = 6 \times \frac{1}{4} = \frac{3}{2}$
and standard deviation

$= \sqrt{npq}$

$= \sqrt{6 \times \frac{1}{4} \times \frac{3}{4}}$

$= \frac{3}{2\sqrt{2}} = \frac{3}{2 \times 1.414} = \frac{3}{2.828}$

$= 1.06$

Mean could also be deducted by following formula

$\frac{\Sigma xf}{\Sigma f} = \frac{6144}{4096} = \frac{3}{2} = 1.5$ Ans

—x—