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DPP-4 Maths- IV Unit-4

Topic- Binomial Distribution

Q-1- If the mean of a binomial distribution is 3 and the variance is $\frac{3}{2}$. find the probability of obtaining at least 4 successes.

Sol- Mean

$$np = 3 \quad -(1)$$

Variance

$$npq = \frac{3}{2} \quad -(2)$$

Divide (2) by (1)

$$\frac{\cancel{np}q}{\cancel{np}} = \frac{\cancel{3}}{2\times\cancel{3}}$$

$$\boxed{q = \frac{1}{2}}$$

We know, $p+q = 1$

$$\therefore \boxed{p = \frac{1}{2}}$$

From eq (1)

$$\boxed{n = 6}$$

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At least 4 successes -

$$P(r \geq 4) = P(r=4) + P(r=5) + P(r=6)$$

$$= {}^6C_4 \left(\frac{1}{2}\right)^4 \left(\frac{1}{2}\right)^2 + {}^6C_5 \left(\frac{1}{2}\right)^5 \left(\frac{1}{2}\right) + {}^6C_6 \left(\frac{1}{2}\right)^6$$

$$= \left(\frac{1}{2}\right)^6 \left[{}^6C_4 + {}^6C_5 + {}^6C_6 \right]$$

$$= \left(\frac{1}{2}\right)^6 \left[\frac{6 \times 5 \times \cancel{4!}}{\cancel{4!} \times 2!} + \frac{6 \times \cancel{5!}}{\cancel{5!} \times 1!} + 1 \right]$$

$$= \left(\frac{1}{2}\right)^6 \left[15 + 6 + 1 \right]$$

$$= \left(\frac{1}{2}\right)^6 \times 22$$

$$= \frac{1}{2^5} \times 11$$

$$\boxed{P(r \geq 4) = \frac{11}{32}}$$

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Q-2- The probability that a bomb dropped from a plane will strike the target is $\frac{1}{5}$. If six bombs are dropped: find the probability that
i) exactly two will strike the target
ii) at least two will strike the target

Sol- $n = 6$

$p = \frac{1}{5}$

$q = 1 - \frac{1}{5}$

$q = \frac{4}{5}$

i) exactly two will strike the target

$$P(r=2) = {}^6C_2 \left(\frac{1}{5}\right)^2 \left(\frac{4}{5}\right)^4$$

$$= \frac{6!}{4!\,2!} \left(\frac{1}{5}\right)^2 \left(\frac{4}{5}\right)^4$$

$$= 15 \times \frac{1}{25} \times \frac{256}{625}$$

$$= \frac{3840}{15625}$$

$$= 0.246$$

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$$P(r \geq 2) = P(r=2) + P(r=3) + P(r=4) + P(r=5) + P(r=6)$$

$$= {}^6C_2 \left(\frac{1}{5}\right)^2 \left(\frac{4}{5}\right)^4 + {}^6C_3 \left(\frac{1}{5}\right)^3 \left(\frac{4}{5}\right)^3 + {}^6C_4 \left(\frac{1}{5}\right)^4 \left(\frac{4}{5}\right)^2$$
$$+ {}^6C_5 \left(\frac{1}{5}\right)^5 \left(\frac{4}{5}\right)^1 + {}^6C_6 \left(\frac{1}{5}\right)^6 \left(\frac{4}{5}\right)^0$$

$$= 0.345$$

Q-3- Fit a binomial distribution to the following frequency data

x:	0	1	2	3	4
F:	30	62	46	10	2

x	f	fx
0	30	0
1	62	62
2	46	92
3	10	30
4	2	8
	$\Sigma f = 150$	$\Sigma fx = 192$

Mean $\Rightarrow$ $\mu = \frac{\Sigma fx}{N} = \frac{192}{150}$

$$\boxed{\mu = 1.27}$$

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For Binomial Distribution

$$\mu = np$$
$$1.27 = 4 \times p$$
$$p = 0.31$$
$$q = 0.69$$

Binomial distribution

$$N(q+p)^n = 150(0.69+0.31)^4$$

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