Assignment 2

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Question: Determine the binomial distribution where mean is 9 and standard deviation is $\frac{3}{2}$ Also, find the probability of obtaining at most one success.

Solution: For binomial distribution :
Given, Mean = 9 and Standard Deviation(S.D) = $\frac{3}{2}$

$$\text{Mean} = np = 9 \tag{1}$$

$$\text{Variance} = (\text{S.D.})^2 = npq = \frac{9}{4} \tag{2}$$

By substituting equation(1) in equation(2):

$$q = \frac{1}{4} \tag{3}$$

Since, p = 1 - q

$$p = 1 - \frac{1}{4} = \frac{3}{4} \tag{4}$$

Using equation (4) in equation (1):

$$n = \frac{9}{p} = \frac{4 \times 9}{3} = 12 \tag{5}$$

Thus Binomial distribution is:

$$(p + q)^n = \left(\frac{3}{4} + \frac{1}{4}\right)^{12} \tag{6}$$

OR

$$P(\text{x=r}) =^{12} C_r \left(\frac{3}{4}\right)^r \left(\frac{1}{4}\right)^{12-r} \tag{7}$$

$$r = 0, 1, 2, 3...$$

P(at most one success) = P(x=0) + P(x=1)

$$=^{12} C_0 \left(\frac{3}{4}\right)^0 \left(\frac{1}{4}\right)^{12} +^{12} C_1 \left(\frac{3}{4}\right)^1 \left(\frac{1}{4}\right)^{11} \tag{8}$$

$$= \left(\frac{1}{4}\right)^{12} + 36 \left(\frac{1}{4}\right)^{12} = \frac{37}{4^{12}} \tag{9}$$