Q7] $X \sim$ Negative Binomial Dist.

$n = 10 \qquad p = 0.05 = 1/20$

$m = 5 \qquad q = 0.95 = 19/20$

$$P(x) = {}^{n-1}C_{m-1}\, p^m q^{n-m}$$

$$P(10) = {}^{9}C_4 \left(\frac{1}{20}\right)^5 \left(\frac{19}{20}\right)^5 = \frac{9 \times \cancel{8} \times 7 \times \cancel{6}}{\cancel{4} \times \cancel{3} \times \cancel{2}} \frac{(19)^5}{(20)^{10}}$$

$$= 126 \times \frac{19^5}{20^{10}}$$

Q8] $X \sim$ Geometric Dist.

$X$ = no. of failures for $1^{st}$ success

$P(x = r) = q^r p \qquad p = 0.4$ (given)

$$P(r < 5) = \sum_{r=0}^{4} (0.6)^r (0.4) = (0.4) \sum_{r=0}^{4} (0.6)^r$$

$$= (0.4) \left[\frac{1-(0.6)^5}{1-0.6}\right] = \frac{\cancel{(0.4)}\,(1-(0.6)^5)}{\cancel{0.4}}$$

$$= 0.9223$$

$X \sim$ Geometric Dist

$X =$ no of failures

$$P(X = r) = q^r p$$

$$P(r = \text{odd}) = \sum_{k=0}^{\infty} q^{2k} p$$

# substituting
$r = 2k$
for even values

$$= p \sum_{k=0}^{\infty} (q^2)^k$$

# $\sum_{n=0}^{\infty} a^n = \frac{1}{1-a}$

given $\rightarrow$

$$0.6 = \frac{p}{1-q^2} = \frac{p}{1-(1-p)^2} = \frac{p}{1-1-p^2+2p}$$

$$\frac{3}{5} \;\; \left(\cancel{\frac{6}{10}}\right) = \frac{p}{2p-p^2} \Rightarrow 6p - 3p^2 = 5p$$

$$\Rightarrow 3p^2 - p = 0 \Rightarrow p(3p-1) = 0$$

$p = 0$ or $p = 1/3$

X

# We chose even values for $X = r$ because then total no. of trials will be odd

$$\underbrace{\text{failures}}_{r\,=\,\text{even}} + \underbrace{\text{success}}_{1^{st}} = \text{Odd}$$

Q11] $X \sim$ Negative Binomial Dist

$X = n =$ no. of trials of 2nd success

$m = 2$

$p = \frac{5}{100} = \frac{1}{20}$

# $m \le n \le \infty$

$$P(X = n \ge 4) = 1 - P(X < 4)$$

$$= 1 - \sum_{n=2}^{3} {}^{n-1}C_1 \left(\frac{1}{20}\right)^2 \left(\frac{19}{20}\right)^{n-2}$$

$$= 1 - {}^{1}C_1 \left(\frac{1}{20}\right)^2 - {}^{2}C_1 \left(\frac{1}{20}\right)^2 \left(\frac{19}{20}\right)$$

$$= 1 - \left(\frac{1}{20}\right)^2 - \frac{2 \times 19}{(20)^3} = 1 - 0.0025 - 0.00475$$

$$= \underline{\underline{0.99275}}$$

Q12] $X \sim$ negative Binomial Dist.

$X =$ no. of shots of 10 baskets

$10 \le n \le \infty$ $\quad m = 10$ $\quad p = \frac{8}{10} = \frac{4}{5}$

a) $pmf = {}^{n-1}C_9 \left(\frac{4}{5}\right)^{10} \left(\frac{1}{5}\right)^{n-10}$ $\quad n \ge 10$

b) $E[X] = \frac{m}{p} = \frac{10}{4/5} = \underline{\underline{12.5}}$

$Var(X) = \frac{mq}{p^2} = \frac{10 \times 1/5}{(4/5)^2} = \underline{\underline{3.125}}$

$(x=12) = {}^{11}C_9 \left(\frac{4}{5}\right)^{10}\left(\frac{1}{5}\right)^2$

$= \frac{11 \times 10}{2} \times \frac{4^{10}}{5^{12}}$

$= \frac{11 \times \cancel{10}}{\cancel{2 \times 5}} \times \frac{4^{10}}{5^{11}} = \frac{11}{5} \times \left(\frac{4}{5}\right)^{10}$

$= \underline{\underline{0.2362}}$

Neha
17 sep 18