Poisson Distribution

(Complete Concepts)

POISSON DISTRIBUTION

Probability of r success

$$m = np$$

$$P(r) = \frac{m^r e^{-m}}{r!}$$

e (1) If the probability of a bad reaction from a certain injection is 0·001, determine the chance that out of 2000 individuals more than two will get a bad reactions.

Solⁿ

$$n = 2000, \quad p = 0.001.$$

$$\therefore \quad m = np = 2000 \times 0.001 = 2.$$

Probability that more than 2 will get a bad reaction by poisson distribution

$$P(3) + P(4) + P(5) \cdots + P(2000)$$

$$= 1 - [P(0) + P(1) + P(2)]$$

$$= 1 - [m^0 e^{-m} + m^1 e^{-m} + m^2 e^{-}$$

$$P(3) + P(4) + P(5) \cdots + P(2000)$$

$$= 1 - \left[P(0) + P(1) + P(2) \right]$$

$$= 1 - \left[\frac{m^0 e^{-m}}{\lfloor 0} + \frac{m^1 e^{-m}}{\lfloor 1} + \frac{m^2 e^{-m}}{\lfloor 2} \right]$$

$$= 1 - e^{-m} \left[1 + 2 + \frac{\cancel{4}^{\,2}}{\cancel{2}} \right]$$

$$= 1 - \frac{5}{m} = 1 - \frac{5}{2} = 0.3233 \quad \text{Ans}$$

Poisson Distribution

Problem#2

Fit a Poisson Distribution to set of observations:

x:	0	1	2	3	4
f:	122	60	15	2	1

Que ② Fit a Poisson distribution to set of observations:

x :	0	1	2	3	4
f :	122	60	15	2	1

$$P(r) = \frac{m^r e^{-m}}{\lfloor r}$$

Sol.ⁿ Mean for grouped data :

$$m = \frac{\sum f_i x_i}{\sum f_i} = \frac{0 + 60 + 30 + 6 + 4}{200 \rightarrow N} = \boxed{0.5 = m}$$

Now, the theoritical frequency for r succes is

$$N \cdot \frac{m^r e^{-m}}{\lfloor r} = 200 \times \frac{(0.5)^r e^{-(0.5)}}{\lfloor r}$$

$$\boxed{e^{-0.5} = 0.6065}$$

$$N \cdot \frac{m^r e^{-m}}{r!} = 200 \times \frac{(0.5)^r e^{-0.5}}{r!}$$

where $r = 0, 1, 2, 3, 4.$

For $r = 0$, $P(0) = 200 \times \frac{(0.5)^0 (0.6065)}{0!} =$

For $r = 1$, $P(1) = 200 \times \frac{(0.5)^1 (0.6065)}{1!} =$

For $r = 2$, $P(2) = 200 \times \frac{(0.5)^2 (0.6065)}{2!} =$

For $r = 3$, $P(3) = 200 \times \frac{(0.5)^3 (0.6065)}{3!} =$

For $r=2$, $P(2) = 200 \times \frac{(0.5)^2 (0.6065)}{\lfloor 2} =$

For $r=3$, $P(3) = 200 \times \frac{(0.5)^3 (0.6065)}{\lfloor 3} =$

For $r=4$, $P(4) = 200 \times \frac{(0.5)^4 (0.6065)}{\lfloor 4} =$

Hence, the theoritical frequencies fitted by poisson distribution are

$x \rightarrow$	0	1	2	3	4
$f \rightarrow$					

Poisson Distribution

1. Binomial Distributio

Problem#3

A manufacturer knows that the condenser he makes contain on an average 1% defective. He packs them in boxes of 100. What is the probability that a box picked at random will contain 3 or more defective condenser?

that a box picked at random will contain 3 or more defective condensor ?

Sol^n Here, $\boxed{p = 0.01} = \frac{1}{100}$; $n = 100$

mean, $m = np = \frac{1}{100} \times 100 = \boxed{1 = m}$

By poisson distribution, the probability that a box picked at random will contain 3 or more defective condensors is

$$P(r) = \frac{m^r e^{-m}}{\lfloor r}$$

$$P(3) + P(4) + P(5) + \cdots + P(100)$$

$$= 1 - [P(0) + P(1) + P(2)]$$

defective condensors is

$$P(r) = \frac{m^r e^{-m}}{\lfloor r}$$

$$P(3) + P(4) + P(5) + \cdots + P(100)$$

$$= 1 - [P(0) + P(1) + P(2)]$$

$$= 1 - \left[\frac{1^0 e^{-m}}{\lfloor 0} + \frac{1^1 e^{-m}}{\lfloor 1} + \frac{1^2 e^{-m}}{\lfloor 2}\right]$$

$$= 1 - e^{-1}\left[1 + 1 + \frac{1}{2}\right]$$

$$= 1 - \frac{1}{e}\left[\frac{5}{2}\right] = 1 - \frac{5}{2e}$$

$$= 0.0803$$

Ans