① Poisson Distribution

If we will consider the distribution of Poisson distribution $P(x) = \frac{e^{-m} m^x}{\lfloor x}$ where $x = 0, 1, 2, 3 \cdots \infty$

$= 1$.

Proof :→ $\Sigma P(x) = P(0) + P(1) + P(2) + P(3) + \cdots \infty$

$= \frac{e^{-m} m^0}{\lfloor 0} + \frac{e^{-m} m^1}{\lfloor 1} + \frac{e^{-m} m^2}{\lfloor 2} + \frac{e^{-m} m^3}{\lfloor 3} + \cdots \infty$

$= e^{-m}\left(1 + \frac{m}{1} + \frac{m^2}{\lfloor 2} + \frac{m^3}{\lfloor 3} + \cdots\right)$ we know that $e^x = 1 + \frac{x}{\lfloor 1} + \frac{x^2}{\lfloor 2} + \frac{x^3}{\lfloor 3} + \cdots$

$= e^{-m} \cdot e^{m}$

$= e^{0}$

$= 1$.

Q → In a certain factory turning out blue lenses, there is a small chance $\frac{1}{500}$ for any one lens to be defective. The lenses are supplied in packets of 10. Use poisson distribution to calculate the approximate number of packets containing no defective, one defective, two defective, three defective lenses respectively in a consignment of 20,000 packets. Given that $e^{-0.02} = 0.9802$.

Solution :→ we know from question :

Total Number of packets = 20,000

Packets contains 10 lens $n = 10$

p = Probability of a defective blue lens = $\frac{1}{500}$

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Now mean = np

$= 100 \times \frac{1}{5000}$

$= 0.02$.

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

$= \frac{e^{-0.02} \times (0.02)^r}{r!}$

where r denotes the number of defective lens.

Hence, in a consignment of 20,000 packets, the frequency of packets containing r defective lens $= 20000 \times \frac{e^{-0.02} \times (0.02)^r}{r!}$

No of packets containing no defective lens

$= 20000 \times \frac{e^{-0.02} \times (0.02)^0}{0!}$

$= 20,000 \times 0.9802$

$= 19604$

No of packets containing 1 defective lens

$= 20,000 \times \frac{e^{-0.02} (0.02)^1}{1!}$

$= 19604 \times 0.02$

$= 392.08$

$= 392$

No of packets containing 2 defective lens

$= 20,000 \times \frac{e^{-0.02} (0.02)^2}{2!}$

$= 3.9208$

No of packets containing 3 defective lens,

$= 20000 \times \frac{e^{-0.02} (0.03)^2}{3!}$

$= 0.026 = 0$

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