Answer on Question #39618 – Math – Other

In a factory turning out razor blade, there is a small chance of 1/500 for any blade to be defective. The blades are supplied in a packet of 10. Use Poisson distribution to calculate the approximate number of packets containing blades with no defective, one defective, two defectives and three defectives blades in a consignment of 10,000 packets.

Solution:

From the conditions above, the probability of defect per razor blade is $p = \frac{1}{500} = 0{,}002$.

$P(X = k) = \frac{\lambda^k e^{-\lambda}}{k!}$ – Poisson distribution, where $k\epsilon\mathrm{N}$ and $\lambda = 10 \cdot 0{,}002 = 0{,}02$,

$k = 0{,}1{,}2{,}3$, k – razors number of defects;

$e^{-\lambda} = e^{-0{,}02} \approx 2{,}7^{-0{,}02} = 0{,}9803$;

$P(X = 0) = \frac{1 \cdot 0{,}9803}{0!} = 0{,}9803$,

$P(X = 1) = \frac{0.02^1 \cdot 0{,}9803}{1!} = 0{,}0196$,

$P(X = 2) = \frac{0{,}02^2 \cdot 0.9803}{2!} = 0{,}000196$,

$P(X = 3) = \frac{0{,}02^3 \cdot 0{,}9803}{3!} \approx 0{,}0000013$.

Than let calculate the approximate number of packets containing blades with 0,1,2,3 defects
$n_{k=0} = 10000 \cdot 0{,}9803 = 9803$,

$n_{k=1} = 10000 \cdot 0{,}0196 = 196$,

$n_{k=2} = 10000 \cdot 0{,}000196 = 2$,

$n_{k=0} = 10000 \cdot 0{,}0000013 \approx 0{,}01 = 0$.

Answer: $n_{k=0} = 9803$, $n_{k=1} = 196$, $n_{k=2} = 2$, $n_{k=0} = 0$.