DPP-6 Maths-4 Unit-4

Topic- Poisson Distribution

Q-1- In a poisson distribution, $P(r)$ for $r=0$ is 10%. find the mean.

Sol- Probability of '0' success in poisson distribution = 10%.

$$P(r=0) = 0.1$$

By Poisson distribution,

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

$$P(r=0) = \frac{\lambda^0 e^{-\lambda}}{0!} = 0.1$$

$$e^{-\lambda} = 0.1$$

$$-\lambda = \log_e 0.1$$

$$\lambda = -\log_e 0.1$$

$$\lambda = -\log_e \frac{1}{10}$$

$$\boxed{\lambda = \log_e 10} = \text{Mean}$$

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Q-2- If X poisson variate such that $P(X=1) = P(X=2)$. find i) mean ii) $P(X=4)$

Sol- For Poisson Distribution

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

$$P(X=1) = P(X=2)$$

$$\frac{e^{-\lambda}\lambda}{1!} = \frac{e^{-\lambda}\lambda^2}{2!}$$

$$2\lambda = \lambda^2$$

$$\lambda^2 - 2\lambda = 0$$
$$\lambda(\lambda-2) = 0$$
$$\lambda = 0, 2$$

Mean = $\lambda = 2$

$$P(X=4) = \frac{e^{-\lambda}\lambda^4}{4!}$$
$$= \frac{e^{-2} \times 2^4}{24}$$
$$= e^{-2} \times 0.67$$
$$= 0.1353 \times 0.67$$

$P(X=4) = 0.0906$

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