**EXAMPLE:**

**Births in a hospital occurs randomly at the at an average rate of 1.8 birth per hour. Find the following probability**

1. Exactly 5 births in an hour?
2. Less than 3 births will occur in a minute?
3. At least 1 births will occur in 5 minutes?
4. The mean of births in an hour is
5. The variance of births in half hour is
6. The variance of births in half hour is

**Solution:**

It is Poisson(1.8) in an hour

$$P\left(X=x\right)=\frac{e^{-1.8}\left(1.8\right)^{x}}{x!} , x=0,1,2,3,………….$$

1. $P\left(X=5\right)=\frac{e^{-1.8 }\left(1.8\right)^{5}}{5!}=0.026$

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b…..

$λ$= 1.8 ---------- 1 hour = 60 minute

= ? ---------- 1 minute\*λ

= $\frac{1.8\*1}{60}= 0.03$ ( in a minute)\*λ

$$P\left(X=x\right)=\frac{e^{-0.03}\left(0.03\right)^{x}}{x!} , x=0,1,2,3,………….$$

$$P\left(X<3\right)=\frac{e^{-0.03 }\left(0.03\right)^{0}}{0!}+\frac{e^{-0.03 }\left(0.03\right)^{1}}{1!}+\frac{e^{-0.03 }\left(0.03\right)^{2}}{2!}=0.9704+0.0291+0.0004=0.9999$$

C……..

$λ$= 0.03 ---------- 1 minute

= ? ---------- 5 minute\*λ

= $\frac{0.03\*5}{1}= 0.15 ( in 5 minutes)$ \*λ

$$P\left(X=x\right)=\frac{e^{-0.15}\left(0.15\right)^{x}}{x!} , x=0,1,2,3,………….$$

P(X ≥ 1) = 1 – P( X<1) = 1 – P(X = 0) =

$$=1- \frac{e^{-0.15 }\left(0.15\right)^{0}}{0!}=1-0.8607=0.1393$$

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

d…..

$λ$= 1.8 ---------- 1 hour

Mean = $λ=1.8$

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

e…………

$λ" $= 1.8/ 2 =0.9 ( in half an hour)

Variance = $λ^{''}=0.9$

 = 0.95 Standard deviation =$\sqrt{0.9 }$

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_