1. **State PMF of Poisson Distribution.**

PMF stands for probability mass function.

The PMF of Poisson Distribution is given by:

P X = x = e − λ λ x x ! , x = 0 , 1 , … ∞ , where λ is a positive number.

1. **Let such that E(X)=4 and SD(X) = √3 find n and p.**

E(X) random values =4

SD(X) random values = √3

E(X)=np=4

SD(X)=npq

(**√3**)2 =4\*q

¾=q

p+q=1

p+3/4=1

p=1-3/4=1/4

1. **State the additive property of Binomial Distribution**

X1 = B(n1p)

X2=B(n2p)

These are independent.

Sum = X1 + X2

1. **State PMF of multinomial Distribution.**

A probability mass function (pmf) is a function over the sample space of a discrete random variable X which gives the probability that X is equal to a certain value.

1. **80% of students who study in a particular University get placed in one year. This year ten students have joined the University. What is the probability that seven of them are placed in that one year?**

P(X = k) = C(n, k) \* p^k \* q^(n-k)

Probability of get placed in one year : 80%=0.8

probability of a student being placed as "p" and the probability of a student not being placed as "q".

p=0.8

q=1-p=0.2

plugging the values, we get

p(X=7)=C(10,7)\*0.8^7\*q^(10-7)=0.201

1. **A coin is tossed 12 times. What is the probability of getting exactly 7 heads?**

P=1/2=0.5

Q=0.5

Plugging the value in binomial distribution

P(X = 7) = C(12, 7) \* (0.5)^7 \* (0.5)^(12-7) = 0.193

**7) If X~B(n1=5, p=1/4) and Y~B(n2=8,p=1/4) .Then what is the distribution of X+Y?**

**8) The mean number of bacteria per milliliter of a liquid is known to be 6. Find the probability that in 1 ml of the liquid, there will be:**

P(X = k) = (λ^k \* e^(-λ)) / k!

**(a) 0,** P(X = 0) = (6^0 \* e^(-6)) / 0! = e^(-6) ≈ 0.0024

**(b) 1,** P(X = 1) = (6^1 \* e^(-6)) / 1! = 6e^(-6) ≈ 0.0148

**(c) 2,** P(X = 2) = (6^2 \* e^(-6)) / 2! = 18e^(-6) ≈ 0.0449

**(d) 3** P(X = 3) = (6^3 \* e^(-6)) / 3! = 72e^(-6) ≈ 0.0899

**(e) less than 4,** P(X < 4) = P(X = 0) + P(X = 1) + P(X = 2) + P(X = 3) ≈ 0.152

**(f) 6 bacteria.** P(X = 6) = (6^6 \* e^(-6)) / 6! ≈ 0.0516

**9) Let the probability that a successful rocket launching will be equal to 0.4. Find,**

probability of successful rocket launching is 0.4

1. **Average number of trials required for the successful rocket launching.**

Average numbers of trials = 1/p = 1/0.4 =2.5

1. **The probability that the successful launching will be made on the third attempt.**

kth attempt in a geometric distribution is given by (1-p)^(k-1) \* p, where k is the trial number and p is the probability of success

=(1-0.4)^(3-1) \* 0.4 = 0.24

1. **The probability that successful rocket launching requires less than 5 attempts.**

k=1: (1-p)^(1-1) \* p = p = 0.4

k=2: (1-p)^(2-1) \* p = (1-0.4) \* 0.4 = 0.24

k=3: (1-p)^(3-1) \* p = (1-0.4)^2 \* 0.4 = 0.144

k=4: (1-p)^(4-1) \* p = (1-0.4)^3 \* 0.4 = 0.0864

successful rocket launching requires less than 5 attempts 0.4 + 0.24 + 0.144 + 0.0864 = 0.8704

**10) State the pmf of negative binomial distribution.**

The probability mass function (PMF) of the negative binomial distribution is given by:

P(X = k) = C(k+r-1, k) \* p^r \* (1-p)^k

where:

X is a discrete random variable representing the number of failures before r successes occur,

k is the number of failures (non-negative integer),

r is the number of successes (positive integer),

p is the probability of success on a single trial (0 < p < 1), and

C(k+r-1, k) is the binomial coefficient, also known as "k+r-1 choose k", which represents the number of ways to choose k items from a set of k+r-1 items.