$= 0.5 \times 0.5 \times 0.5$ $= 0.125$

Example:

If 4 people say that they like orange fanta and 3 people say they like grape fanta. can you conclude that people in general prefer orange fanta?

Solution:

$n=7, x=4, (n-x)=3.$

$$P(x=4 | n=7, p=0.5) = \frac{7!}{4!(7-4)!} \times (0.5)^4 \cdot (0.5)^{7-4}$$

$$= \frac{7!}{4! \times 3!} (0.5)^{7}$$

$$= 5 \times 7 \times (0.5)^7$$

$$= 35 \times (0.5)^7$$

$$= 0.273$$

0.273 is the probability that people in general prefer orange fanta.

POISSON DISTRIBUTION:-

* It is a discrete probability distribution of a discrete random variable X, which has no upper bound.
* It is defined for non-negative values of x.
* It is suitable for rare events for which the probability of occurence p is very small and the trials of n is very large.

Formula:

$$P(x|n,p) = \frac{n!}{x!(n-x)!} p^x (1-p)^{n-x}$$

$x \rightarrow$ no. of people who preferred orange fanta, ~~n=2~~ $x=2$

$n \rightarrow$ Total no. of people we asked, $n=3$

$(n-x) \rightarrow$ No. of people who preferred grape fanta

$P \rightarrow$ Probability that someone will pick up orange fanta ($p=0.5$).

$(1-p) \rightarrow$ Probability that someone will pick up grape fanta ($1-0.5=0.5$)

$p^{(x)} \rightarrow$ probability that orange fanta is picked up 2 (twice).

$(1-p)^{n-x} \rightarrow$ &someone preferred grape fanta.
$(1-0.5)^{3-2} = 0.5$

$$P(x=2|3,p=0.5) = \frac{3!}{2!(1!)} (0.5)^2 (1-0.5)^{3-2}$$

$$= 3 \times (0.5)^3 = 3 \times 0.125 = 0.375$$

0.375 is the same value received through manual calculation.

What is the probability that all will pick orange fanta?

$n=3, x=3.$ $P(3|3,p=0.5) = \frac{3!}{3!(3-3)!} \times (0.5)^3 (1-0.5)^{3-3}.$

Semester 4 Subject Statistics for AIDS Academic Year 2023-24

Example:

* No. of printing mistakes per page.
* No. of accidents on a highway.
* No. of defectives in a production center.
* No. of telephone calls during a particular loads of times.

Formula:

The poisson probability mass function:

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

$\mu = \lambda$, $\sigma^2 = \lambda$ → The mean and variance of poisson distribution is equal to lamba (λ).

Standard Deviation → σ

The rpois function in R does this, taking only two arguments — the quantity of random numbers sought, and lambda:

```
rpois (100, lambda = 2)
```

This code will generate 100 random numbers from a Poisson Distribution with $\lambda = 2$, For example, if incoming customer service calls average 2 per minute this code will simulate 100 minutes, returning the number of calls in each of those 100 minutes.

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Example:

A variable X follows Poisson distribution with variance 3. Calculate P(X=2).

Solution:-

Variance = Mean = $\lambda = 3$., $e = 2.718$

$$P(X=2) = \frac{e^{-\lambda} \cdot \lambda^x}{x!}$$

$$= \frac{(2.718)^{-3} \cdot 3^2}{2!}$$

$$= \frac{9}{(2.718)^3 \cdot 2}$$

$$= 0.224$$