X : No of Outcomes

11. Probability Distribution

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→ A Probability Distribution is a formula or a table used to assign probabilities to each possible value of a random variable X. A probability distribution may be either discrete or continuous.

Discrete Distribution

X can assume one of a countable (usually finite) no of values.
e.g – Coin toss X, Roll of Dice

Continuous Distribution

X can assume one of the infinite (uncountable) no of different values

e.g. Weight of a person

probability that weight of a person weighs 60 kg from the sample of 100 persons.

Discrete Distribution Types

Binomial

Random variable x is the no of successes in a "n" independent and identical trials, where each trial has fixed probability of success.

e.g.: Coin Toss (Outcome is binary / binomial)
Probability remains constant.

Hypergeometric

Random variable x is the no of objects that are special, among randomly selected "n" objects from a bag that contains a total of N out of which K are special.

Poisson

Random Variable x counts the no of occurrences on an event in a given period, where we know that the occurrences has an average of λ for any period of that length, independent of any other disjoint period.

Binominal Distribution

eg 1 What is the probability of getting 4 heads when you toss the coin 10 times?

→ When a coin is 10 times,

no of heads for 10 flips is from 0 to 10.

Formula for finding probability

= BINOM.DIST(number_s, trials, probability_s, cumulative)

number_s ⇒ X (no of heads) (outcomes)

trials ⇒ no of trials (10)

probability_s ⇒ 0.5 (for coin Toss)

cumulative ⇒ False : Probability Mass Function

Probability Mass Function (False) ⇒ Unique value of 4 Heads

Cumulative Distribution fn (True) ⇒ Upto 4 Heads
Adding $\underline{\underline{P}}$ of 0, 1, 2, 3 & 4

~~eg Probability of getting more than 4 heads.~~

=BINom. DIST(/)

e.g. 2 Probability of defects is 20%.

In a lot of 5 pieces, what is the probability of getting 2 defects?

= BINOM. DIST (2, 5, 0.2, FALSE)

Binomial	HyperGeometric	Poission
binary outcomes	binary outcomes	binary outcomes.
trials are independent	trials are dependent	trials are independent
trials are fixed	trials are fixed	trials are not fixed
P is constant	P is constant	P is constant

Hypergeometric Distribution

→ Without Replacement

→ We are creating Sample Set (Subset) from the population

→ We are trying to find out probability of something happening from that sample

e.g.1. A consignment of 20 microprocessors has arrived. 4 out of the 20 in the consignment are actually defective. To check the consignment the buyer randomly checks 3 microprocessors. Find the probability that the buyer find two or more defective processors in the check conducts

Formula:

=HYPGEOM.DIST(sample_s, number_sample, population_s, number_pop, cumulative)

sample_s ⇒ no of defective processors $= k = 2 \,\&\, 3$

number_sample ⇒ no of sample taken $= n = 3$.

population_s ⇒ no of Total defective processors $= K = 4$

number_pop ⇒ Total no of processors $= N = 20$

e.g. 2 A HRD manager randomly selects 3 individuals from a group of 10 employees for a special assignment. Assuming that 4 of the employees were assigned to a similar assigment previously, determine the probability that exactly 2 of the 3 employees have had previous experience

Sample_s ⇒ k = 2

number_sample ⇒ n = ~~4~~ 3

population_s ⇒ K = ~~3~~ 4

number_pop ⇒ N = 10

= HYPGEOM.DIST (2, 3, 4, 10, False)

Poission Distribution

→ A poission distribution is a statistical distribution showing the likely no of times that an event will occur within a specified period of time. It is used for independent events which occur at a constant rate within a given interval of time

→ The Poission distribution is a discrete fn, meaning that the event can only be measured as occuring or not as occuring, meaning variable can only be measured in whole numbers. Fractional occurences of the event are not a part of the model.

examples:

* No of insurance claims in a month

* Disease spread in a day

* No of telephone calls in a hour

* No of patients needing emergency services in a day

e.g. 1 You are a Manager in a call center with a staff of 55 people, who on average handle 330 calls in a hour. A holiday is coming up and 5 resources want leave. You estimate the 50 remaining resources can manage 20% greater calls, but want to plan for the chance of greater than 20% increased call volume.

What are the chances that no of calls on that day will go up by more than 20%?

$\lambda = \frac{330}{55} = 6$ calls a hour

20% greater calls 5 less resources

$= \frac{330 \times 1.2}{50} = 7.2 \approx 7$ calls a hour

* We need Probability of seeing 8 or more calls a hour when average is 6.

Formula

= Poisson.DIST (X, mean, Cumulative)

X ⇒ no of calls

mean ⇒ λ

= Poission.DIST (7, 6, TRUE)

⇒ Probability of getting 7 calls in a hour

Probability of getting >7 Calls a hour
= 1 − Poisson.DIST (7, 6 TRUE)

Continuous Distribution

Normal Distribution

e.g. 1. We test 100 individuals and find that their weight is normally distributed with an average of 108 and a standard deviation of 7.

Supposing you pick a random individual from 100, what are the chances that he/she who weighs greater than 115?

Formula

=NORM.DIST (X, mean, standard deviation, cumulative)

X ⇒ 115

mean ⇒ 108

SD ⇒ 7

P = 1- NORM.DIST(115, 108, 7, TRUE)