Random variable is a variable whose value is unknown and whose value is dependent on outcomes of a random experiment.

Random Variable

Discrete Random variable:-
A numerical r.v. takes a countable number of values.

- No of phone calls received in a day
- No of Children in the family. Etc

Continuous Random variable:-
A numerical r.v takes all possible value within a certain range.

- Percentage of marks obtained by Student.
- Time required to finish the test
- Height of person .

Probability Distribution

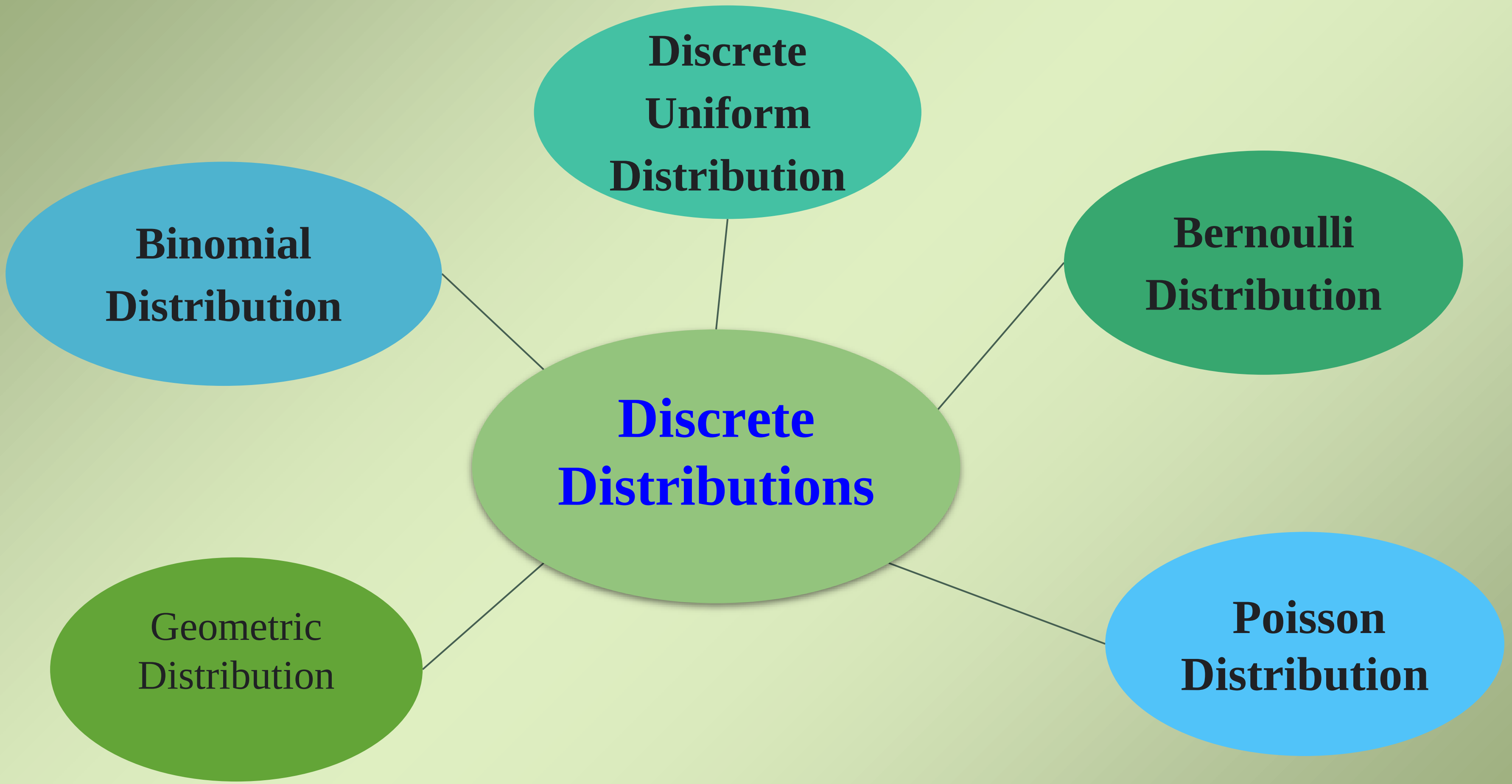
A probability distribution is the mathematical function that gives the probabilities of occurrence of different possible outcomes for an experiment

If a random variable X takes value x1,x2,...xn with the Prob. p1 ,p2,.....pn then the Prob distribution is,

X	x1	x2	………………....	xn
P(X)	p1	p2	……………..	pn

Xi	0	1	2
P(Xi=xi)	?	0.3	0.5

Discrete Probability Distributions

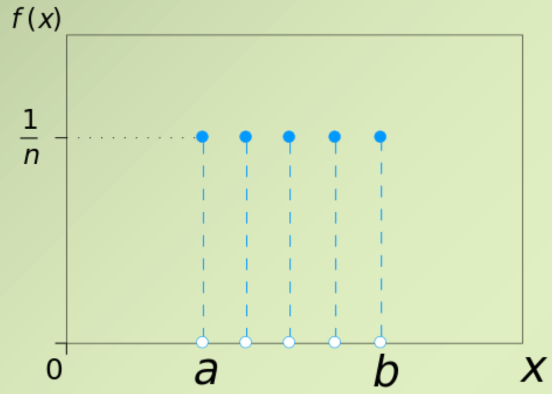


Discrete Uniform Distribution

A discrete uniform distribution is a distribution where finite no. of values are equally observed.

In discrete uniform distribution the probability remains same for each value.

Here, pmf = P(X=x) = 1/n , where x = 1,2,3, … , n.



Situation where its applicable

1.The birthday of a person may occur on either Sunday, Monday,….., Saturday with the same probabilities 1/7.

Bernoulli Distribution

A discrete random variable X in Bernoulli distribution takes value 1 with probability p and the value 0 with probability q = 1 - p.

Here we perform single experiment where we ask yes-no questions. For the outcome we get two values: yes is success with probability p and no is failure with probability q. In other words single success/failure experiment is called bernoulli trial.

Ex.

If P(yes) = P(X=1) = 0.2 then P(no) = P(X=0) = 0.8

Pmf = $\begin{cases} q = 1 - p & \text{if } k = 0 \\ p & \text{if } k = 1 \end{cases}$ where $0 \leq p \leq 1$

Situation where its applicable

1. Tossing of a coin.
2. Result of exam either pass or fail
3. Probability of having a boy child.

Factorial:-

The Product of first n natural numbers is called a factorial.

Factorial is denoted by the symbol

“ ! “

n! = n*(n-1) *(n-2)*.................3*2*1.

Example:-

5! = 5*4*3*2*1

= 120

3! = 3*2*1

= 6.

Combination:-

A group of same or all of given objects without considering their order is called combination and is given by,

$$nCx = \frac{n!}{(n-x)! * x!}$$

$$nCx = \frac{n!}{(n-x)! * x!}$$

$$5C3 = \frac{5!}{(5-3)! * 3!}$$

$$5C3 = \frac{5 * 4 * 3 * 2 * 1}{2! * 3!}$$

$$5C3 = \frac{5 * 4 * 3 * 2 * 1}{(2 * 1) * (3 * 2 * 1)}$$

$$5C3 = \frac{60}{6}$$

$$5C3 = 10$$

Binomial Distribution:-

Binomial distribution has two parameters ‘n’ and ‘p’. The Binomial distribution is simply counting a things, ex. No of defective products.

Here we perform n independent experiment where we ask yes-no questions. For the outcomes we get two values: yes is success with probability p and no is failure with probability q. Here we’re interested in calculating no. of successes probability.

Pmf = $f(k,n,p) = \Pr(k;n,p) = \Pr(X=k) = \binom{n}{k} p^k (1-p)^{n-k}$

For k = 0, 1, 2, … , n where,

$\binom{n}{k} = \frac{n!}{k!(n-k)!}$ = Different way of distributing k successes in a sequence of n trials.

and P = probability of Success , q = probability of Failure, n = No of trials.

P(X=k) means probability of getting exactly k successes in n independent Bernoulli trials.

k successes occur with probability p^k

n − k failures occur with probability $(1 - p)^{n-k}$

Note: n=1, the Binomial distribution is a Bernoulli distribution.

Binomial Distribution:-

Situation Where its Applicable

1. Suppose it is known that 2% of all credit card transactions in a certain region are fraudulent. If there are 100 transactions per day in a certain region.What is the probability that 2 fraudulent transactions occur in a given day.

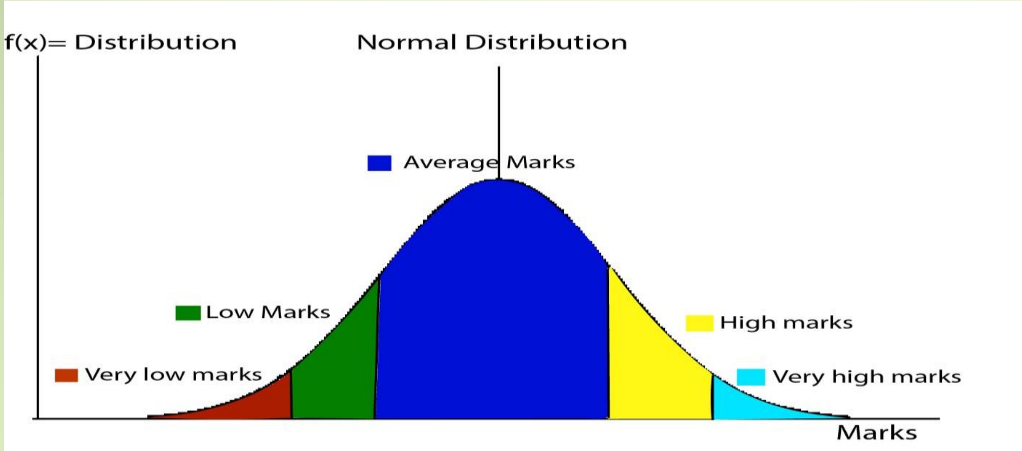
2. The likelihood that a patient with a heart attack dies of the attack is 0.04 (i.e., 4 of 100 die of the attack). Suppose we have 5 patients who suffer a heart attack, what is the probability 1 will die from the attack?

Continuous Probability Distributions

Normal Distribution:-

Normal Distribution is also called as Gaussian distribution. It is type of Continuous probability distribution.

It has two parameters μ is a mean and σ is a standard deviation.



Properties of Normal Distribution:-

1. The Normal Distribution is bell Shaped(Symmetric).
2. The mean, median and mode are equal for Normal Dist.
3. Most of the Discrete distribution tends to Normal Dist as N tends to infinity.

Examples:-

1. Weight of the newborn Babies.
2. Marks of the students.