“A Cinematic Journey through Statistical Distributions”

-KUNAL SINGH

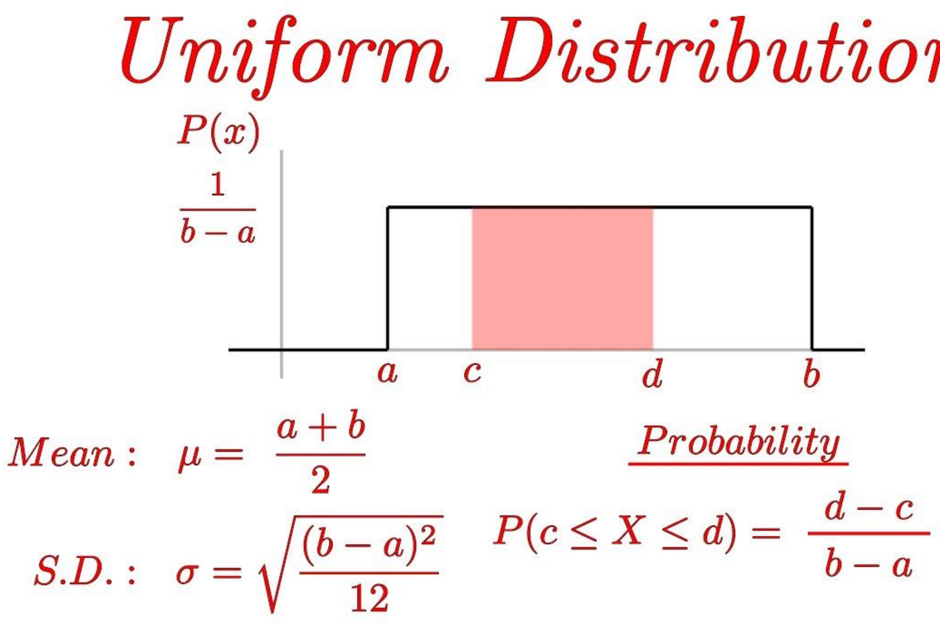
In a very layman term, Statistical distribution can be defined as a graphical representation of a given data in terms of its probability of occurring. A statistical distribution also known as a probability distribution, is a mathematical function that describes the likelihood of different outcomes or values in a dataset. In other words, it specifies the probabilities associated with various possible results in a random experiment or process.

Moving further let us see different types of statistical distributions and their real-life examples:

1. **Uniform Distribution:**
   Any event where the outcome of probabilities for all the events are equally likely then we get Uniform Distribution.

   Ex- rolling of a fair die. The outcomes are 1-6. The probabilities of getting these outcomes are equally likely = 1/6.

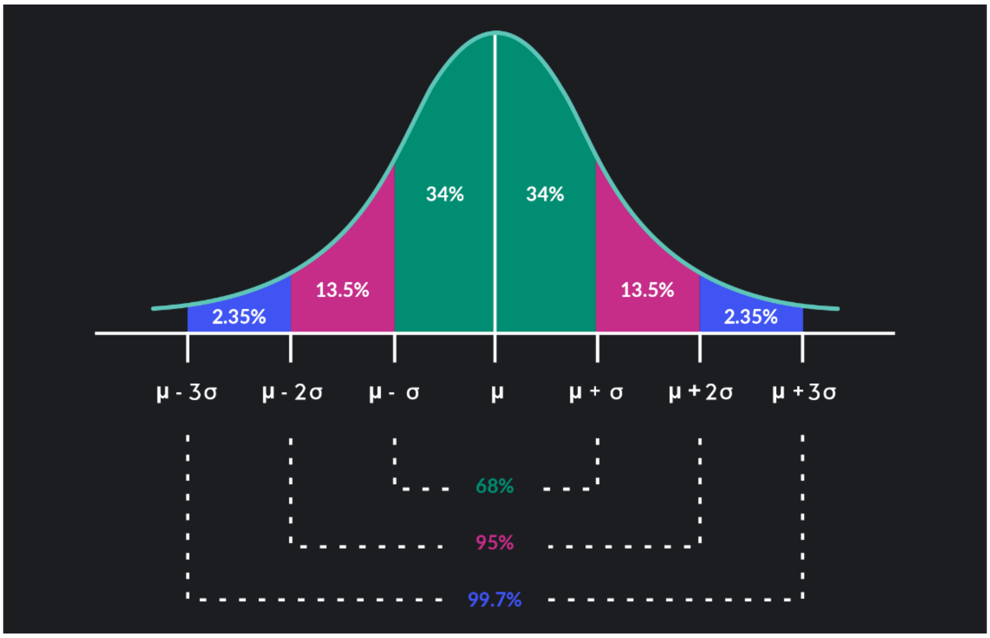
   The graph of Uniform Distribution is constant as all the probabilities are same for all the events.



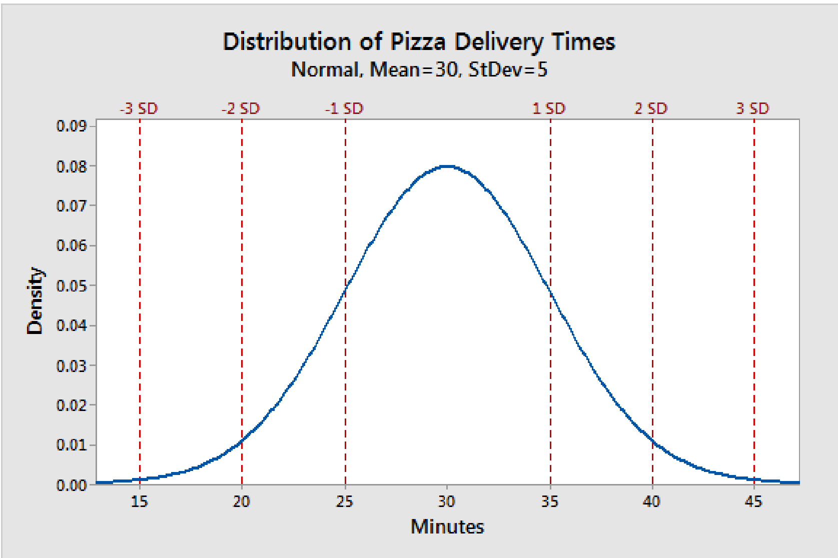
2. **Normal Distribution or Gaussian Distribution:**

The normal distribution represents the behaviour of most if the situations in the universe. A normal distribution is a type of probability distribution where most data points cluster around the middle of the range. The middle of the range is also known as the mean of the distribution. A normal distribution has following characteristics:

1. The mean, median, and mode of the distribution coincide.
2. The curve of the distribution is bell-shaped and symmetrical about the line.
3. The total area under the curve is 1.
4. Exactly half of the values are to the left of the centre, and the other half to the right.



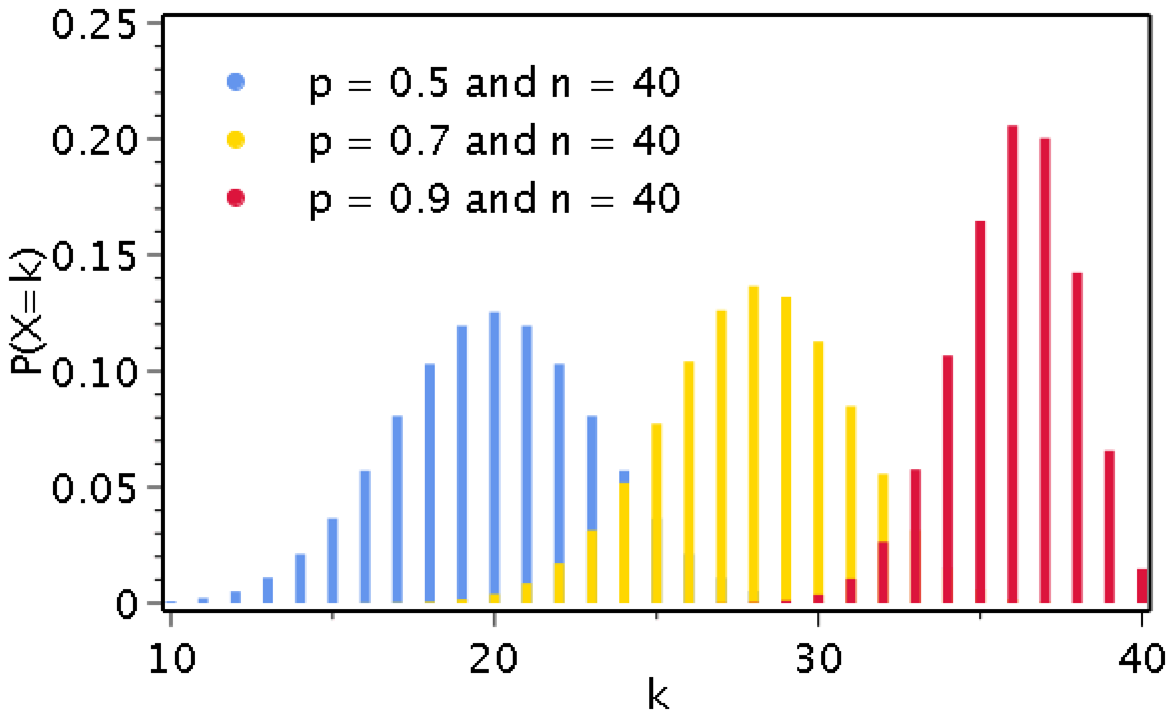
Example :



3. **Binomial Distribution:**

A distribution where only two outcomes are possible, such as success or failure, win or lose and where the probability of success and failure is the same for all the trials is called as Binomial Distribution.

A binomial distribution is a discrete distribution, as opposed to continuous distribution, such as the normal distribution. Here, the outcomes need not be equally likely and each trials are independent.



Key characteristics of binomial distribution:

1. **Parameters**: The binomial distribution is defined by two parameters.
   n : The total number of trials.
   p: The probability of success on any given trail.
2. **Random Variable**: The random variable X follows a binomial distribution. X~Binomial*(n,p)*
3. **Probability Mass Function:** The probability mass function of the binomial distribution calculates the probability of obtaining exactly *k* success in *n* trials. It is given by:
   $$P(X=k)=\binom{n}{k}\cdot p^{k}\cdot(1-p)^{n-k}$$
4. **Mean and Variance**: The mean of a binomial distribution is given by *np*, and the variance is *np(1-p)*

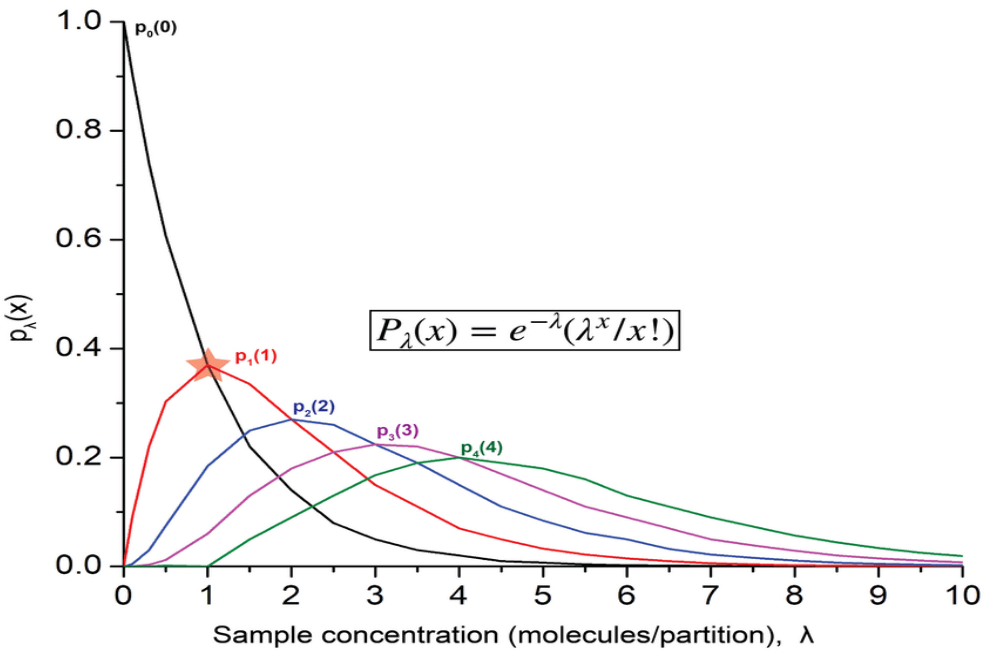
Example: The number of heads obtained when flipping a coin n times, where p is the probability of getting heads.

4. **Poisson distribution:**

The Poisson distribution is a probability distribution used in statistics to predict how many times an event will occur in a given time period. It is a discrete distribution that gives the probability of a number of events. The Poisson distribution is used to model the number of times an event occurs in an interval of time or space.

Example:

1. The number of emergency calls recorded at a hospital in a day.
2. The number of thefts reported in an area in a day.
3. The number of customers arriving at a salon in an hour.
4. The number of printing errors on each page of the book.



1. The Poisson distribution is defined by a single parameter, lambda λ.
2. **PMF**: The probability mass function of the Poisson distribution calculates the probability of observing k events in the interval.

$$P(X=k)= e^{-\lambda} \cdot \lambda^{k} / k!$$

where:

- e is the base of the natural logarithm (approximately 2.71828).
- λ is the average rate of events.
- k is the number of events observed.
- $k!$ is the factorial of k, representing the number of ways to arrange k events.

/ KUNAL SINGH