Exponential Distribution

The exponential distribution, also known as the negative exponential distribution, is a continuous probability distribution that models the time elapsed between events in a process where events occur continuously and independently at a **constant average rate**. It's useful in various situations where events happen randomly over time, such as:

- **Customer arrival times in a store**
- **Time between machine failures in a factory**
- **Radioactive decay events**
- **Call arrival times in a call center**

Single Parameter (λ):

The exponential distribution is characterized by a single parameter, λ (lambda), which represents the **average rate** of events occurring. A higher λ value indicates a higher event occurrence rate and shorter intervals between events. Conversely, a lower λ value signifies a lower event rate and longer intervals between events.

Probability Density Function (PDF):

The PDF (f(x)) of the exponential distribution defines the likelihood of observing an interval of time (x) between events:

$$f(x) = \lambda * e^{(} - \lambda x)$$

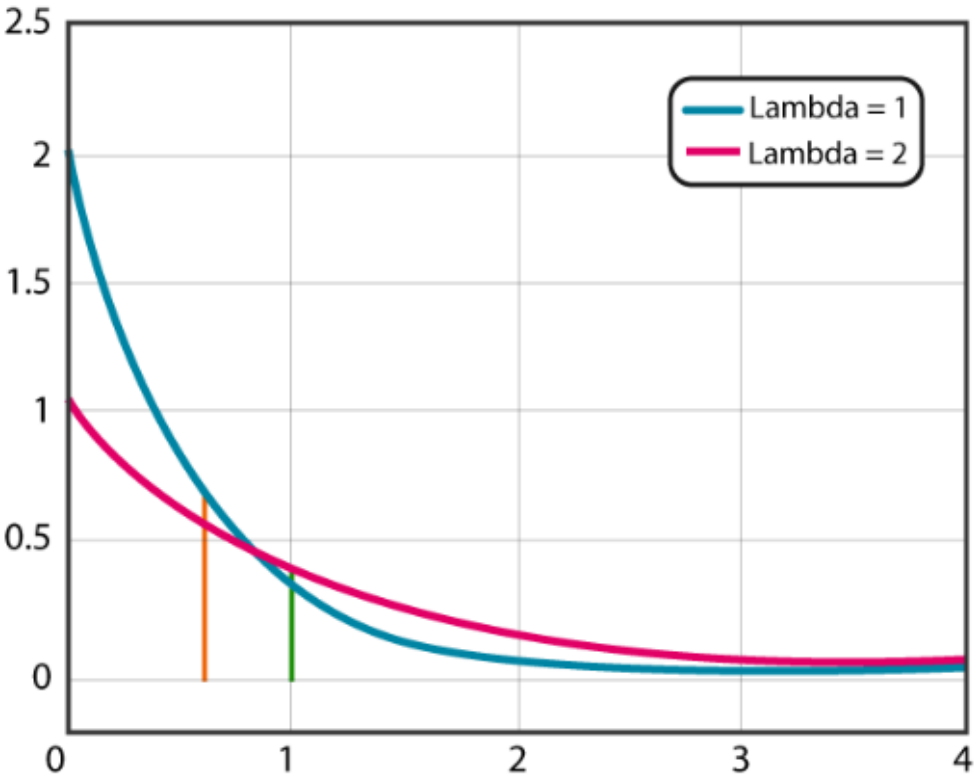
Here's a breakdown of the terms:

- **x:** Represents the time elapsed between events (non-negative value).
- **λ:** Represents the average rate of events (positive value).
- **e:** Represents the base of the natural logarithm (approximately 2.71828)

Cumulative Distribution Function (CDF):

The Cumulative Distribution Function (CDF) (F(x)) of the exponential distribution provides the probability that the time elapsed between events will be less than or equal to a specific time (x):

$$F(x) = 1 - e^{(} - \lambda x)$$



Exponential Distribution Applications

One of the widely used continuous distribution is the exponential distribution. It helps to determine the time elapsed between the events. It is used in a range of applications such as reliability theory, queuing theory, physics and so on. Some of the fields that are modelled by the exponential distribution are as follows:

- Exponential distribution helps to find the distance between mutations on a DNA strand
- Calculating the time until the radioactive particle decays.
- Helps on finding the height of different molecules in a gas at the stable temperature and pressure in a uniform gravitational field
- Helps to compute the monthly and annual highest values of regular rainfall and river outflow volumes