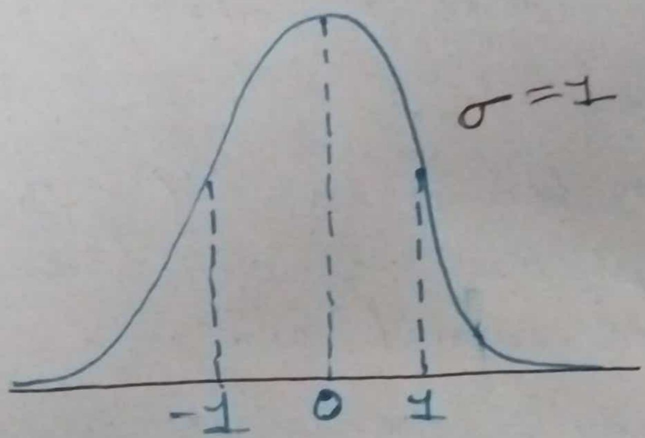
Standaard Noormal Distribution

Standard normal distribution is a special case of normal distribution obtained when mean takes the value "0" and the standard deviation takes "1".

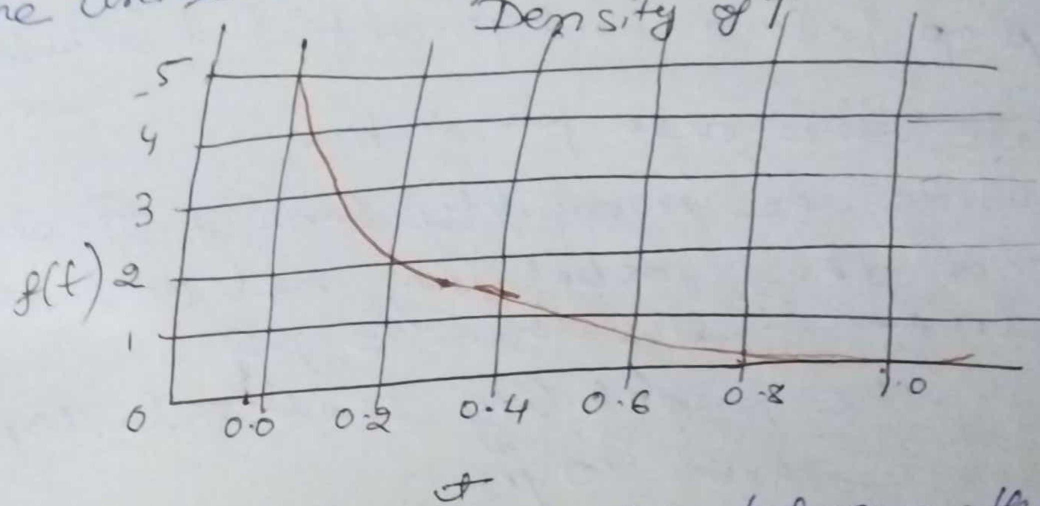


Expontential Distribution

The exponential distribution is often concerned with the amount of time until specific event occurs. For example, the amount of time (beginning now) until an earthquake occurs has an exponential distribution. Other examples include the long distance business telephone calls, and the amount of time, in months, a car battery that lasts. It can be shown, too, that the value of the change that you have in your pocket or purse approximately follows an exponential distribution.

The exponential distribution has the memoryless property which says that fact future probabilities do not depend on any past information.

Exponential distribution is a continuous probability distribution that often concerns the amount of time until some specific event happens.



- There is a strong relationship between the Poisson distribution and the Exponential distribution. For example, let's say a Poisson distribution models the number of births in a given time period. The time in between each birth can be modelled with an exponential distribution.

- This distribution has memoryless property which means it 'forgets' what has come before it.

What is the Exponential Distribution used for?

↳ The exponential often model waiting times ~~and~~ and can help you to answer questions like:

- "How much time will go by before a major cyclone hits the land?"
- "How long will the ~~transmitted~~ transmission in my car last before it breaks?".

↳ The exponential distribution is mostly used for testing product ~~rea~~ reliability.

(3) Laptops produced by company XYZ last on average for 5 years. The life span of each laptop follows an exponential distribution.

(a) Calculate the rate parameter.

(a) ~~what~~ Write the probability density function.

(b) What is the probability that a laptop will ~~last~~ less than 3 yrs.

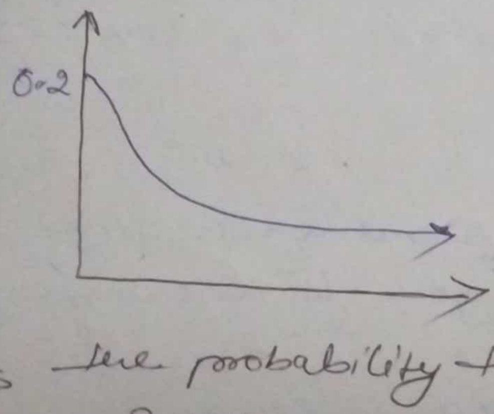
(c) What is the probability that a laptop will last more than 10 yrs.

(d) What is the probability that a laptop will last between 4 and 7 years

(a) $\lambda = \frac{1}{\mu} = \frac{1}{5} = 0.20$

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

$= 0.20e^{-0.20x}$ $\quad e = 2.7182$



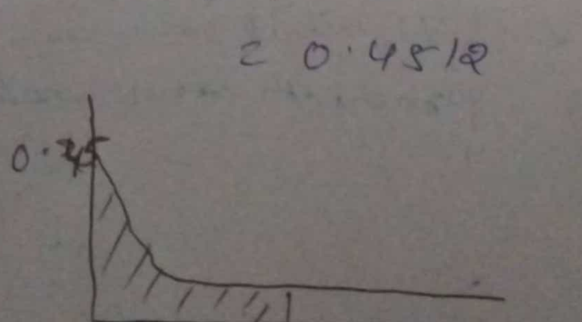
(c) What is the probability that a laptop will last less than 3 years.

$P(X < x) = 1 - e^{-\lambda x}$

$P(X < 3) = 1 - e^{-0.20(3)}$

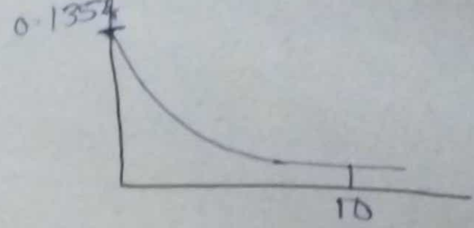
$= 1 - e^{-0.6}$

$= 0.4512$



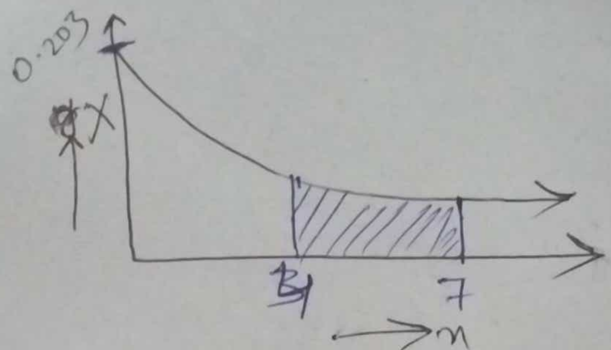
(i) $P(X>x) = e^{-\lambda x}$

$$P(X>10) = e^{-0.20(10)} = e^{-2} = 0.1352$$



(ii) $P(X<x) = P(4<x<7)$

$$= P(X<7) - P(X<4)$$
$$= \left[1 - e^{-0.20(7)}\right] - \left[1 - e^{-0.20(4)}\right]$$
$$= [0.75340] - [0.55067]$$
$$= 0.20273$$



Exponential Distribution

X is said to ~~be~~ have an exponential distribution with parameter $\lambda (>0)$ if its pdf is

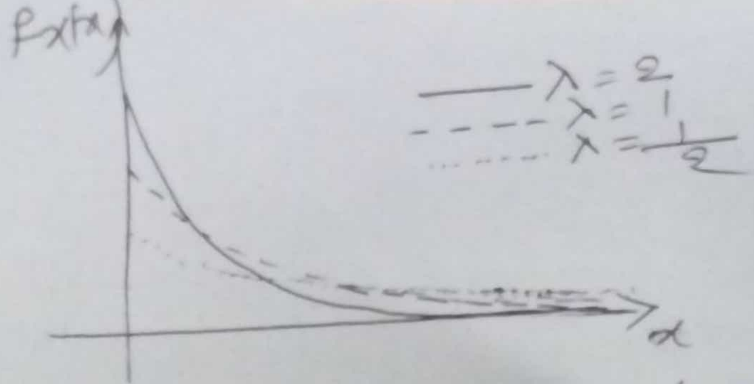
$$f(x;\lambda) = \begin{cases} \lambda e^{-\lambda x} & x \geq 0 \\ 0 & x < 0 \end{cases}$$

Cdf, Mean and Variance of Exponential Distribution for X having an exponential distribution with parameter λ.

$$F(x;\lambda) = \begin{cases} 1 - e^{-\lambda x} & x \geq 0 \\ 0 & x < 0 \end{cases}$$

and

$$E(X) = \frac{1}{\lambda}, \quad Var(X) = \frac{1}{\lambda^2}$$

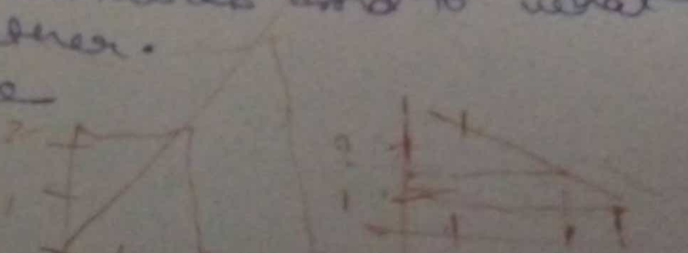



```
from numpy import random
import matplotlib.pyplot as plt
import seaborn as sns
x = random.exponential(scale=2, size=(2,3))
print(x)
sns.distplot(random.exponential(size=1000),
                                hist=False)

plt.show()
```

Covariance

- Covariance is a measure of the relationship between two random variables and to what extent, they change together.
- The value of covariance lies b/w $-\infty$ and $+\infty$
- Sensitive to scale of the data.



Population Covariance Formula

$$\mathrm{Cov}(x,y) = \frac{\Sigma (x_i-\bar{x})(y_i-\bar{y})}{N}$$

Sample Covariance

$$\mathrm{cov}(x,y) = \frac{\Sigma (x_i-\bar{x})(y_i-y)}{N}$$

where,

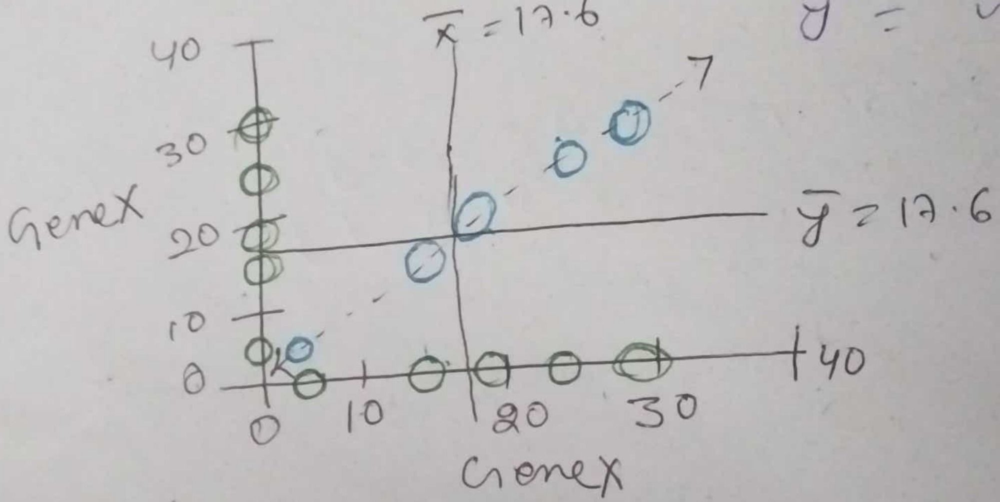
x_i = data value

y_i = data value of y

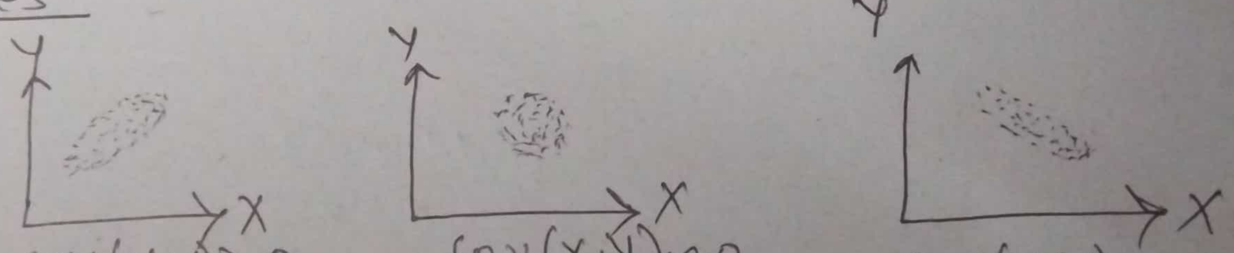
$\bar{x}$ = mean of x

$\bar{y}$ = " " y

N = number of data values



Types



cov(X,Y) > 0   cov(X,Y) ≈ 0   Cov(X,Y) < 0

- If cov(X,Y) is greater than zero, then we can say that the covariance for any two variable is positive and both the variables move in the same direction.
- If cov(X,Y) is less than zero, then we can say that the covariance for any two variables is negative and both the variables move in the opposite direction.
- If cov(X,Y) is zero, then we can say that there is no relation between two variables.

python code to demonstrate the use of
numpy. cov

```
import numpy as np
x = [1.23, 2.12, 3.34, 4.5]
y = [2.56, 2.89, 3.76, 3.95]
# find out covariance with respect columns
cov_mat = np.stack((x, y), axis=0)
print(np.cov(cov_mat))
```

Output

```
[[ 2.0362916?     0.9313 ]
 [0.9313          0.4498 ]]
```