

Assignment 3

Vaddamani Saketh - CS20BTECH11054

Download all python codes from

https://github.com/CS20BTECH11054/AI1103/blob/main/Assignment_3/codes/Assignment_3.py

and latex-tikz codes from

https://github.com/CS20BTECH11054/AI1103/blob/main/Assignment_3/Assignment_3.tex

1 PROBLEM

A continuous random variable X has a probability density function $f(x) = e^{-x}$, $0 < x < \infty$, then $\Pr(X > 1)$ is

2 SOLUTION

Let the CDF of $f(x)$ be denoted by $F_X(x)$
We know that,

$$d(F_X(x)) = f(x) dx \quad (2.0.1)$$

Therefore, applying definite integral on both sides from 0 to x in (2.0.1), we get,

$$\int_0^x d(F_X(x)) = \int_0^x f(x) dx = \int_0^x e^{-x} dx$$

$$F_X(x) - F_X(0) = e^{-0} - e^{-x} = 1 - e^{-x} \quad (2.0.2)$$

We know that, there is no probability for the random variable X to satisfy $X \leq 0$, So, for $x = 0$ $F_X(0)$ should be zero. So,

$$F_X(0) = 0 \quad (2.0.3)$$

Substituting (2.0.3) in (2.0.2), we get

$$F_X(x) = 1 - e^{-x} \quad (2.0.4)$$

We know that, by definition

$$\Pr(X > x) = 1 - F_X(x) \quad (2.0.5)$$

Substituting (2.0.4) and $x=1$ in (2.0.5), we get

$$\Pr(X > 1) = 1 - F_X(1) = 1 - (1 - e^{-1}) \quad (2.0.6)$$

$$\Pr(X > 1) = e^{-1} \quad (2.0.7)$$

Therefore, $\Pr(X > 1) = \frac{1}{e}$

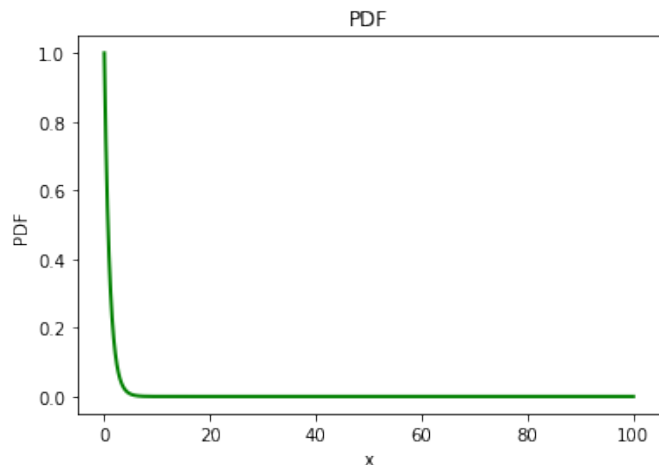


Fig. 0: **PDF**

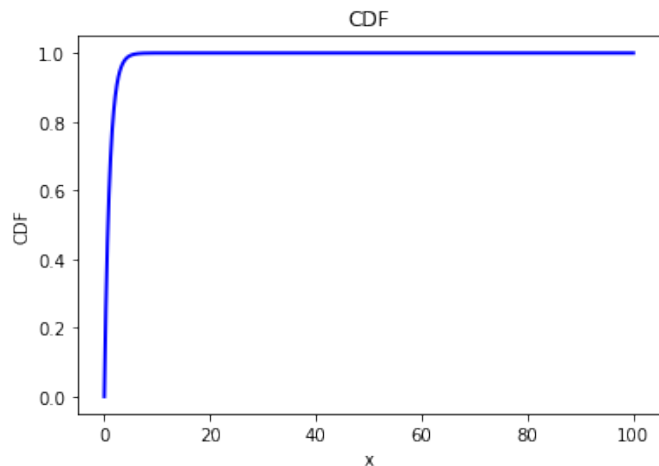


Fig. 0: **CDF**