ASSIGNMENT 4

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Download all python codes from

https://github.com/manik2255/AI1103−PROBABILITY−AND−RANDOM−VARIABLES/blob/main/ASSIGNMENT_4/assignment_4.py

and latex-tikz codes from

https://github.com/manik2255/AI1103−PROBABILITY−AND−RANDOM−VARIABLES/blob/main/ASSIGNMENT_4/ASSIGNMENT_4.tex

1 GATE 2017 MA PROBLEM.49

Let X and Y be independent and identically distributed random variables with probability density function $f(x) = \begin{cases} e^{-x} & x > 0 \\ 0 & otherwise \end{cases}$ Then $\Pr(max(X, Y) < 2)$ equals

2 SOLUTION

Given,

$$f(x) = \begin{cases} e^{-x} & x > 0 \\ 0 & otherwise \end{cases} \tag{2.0.1}$$

We know,

$$\Pr(X < x) = \int_0^x f(x)\, dx \tag{2.0.2}$$

Using (2.0.1) in (2.0.2),

$$\Pr(X < x) = \int_0^x e^{-x}\, dx \tag{2.0.3}$$

We need to find $\Pr(max(X, Y) < 2)$,which is also can be written as

$$\Pr(max(X, Y) < 2) = \Pr(X < 2 \; and \; Y < 2) \tag{2.0.4}$$

As X and Y be independent random variables,

$$\Pr(max(X, Y) < 2) = \Pr(X < 2)\Pr(Y < 2) \tag{2.0.5}$$

Using (2.0.3) in (2.0.5),

$$\Pr(max(X, Y) < 2) = \{\int_0^2 e^{-x}\, dx)(\int_0^2 e^{-y}\, dy) \tag{2.0.6}$$

$$= [-e^{-x}]_0^2 [-e^{-y}]_0^2 \tag{2.0.7}$$

$$= 0.748 \tag{2.0.8}$$

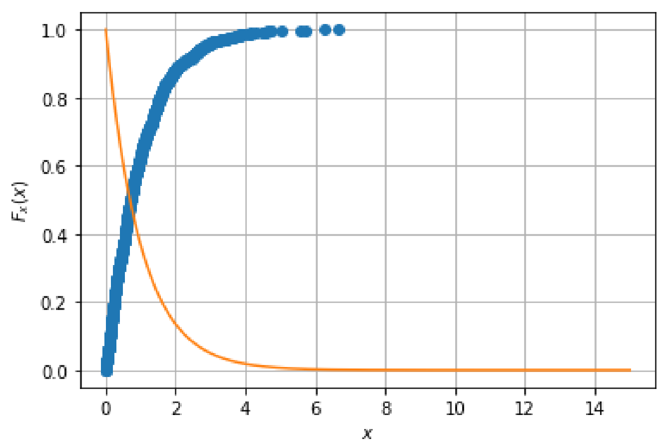

Fig. 1: CDF of random variable X