

AI5002: Assignment 14

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AI20RESCH11003

Download all Python codes from

https://github.com/Debolena/AI5002-Probability-and-Random-Variables/blob/main/Assignment_14/code.py

and latex-tikz codes from

https://github.com/Debolena/AI5002-Probability-and-Random-Variables/blob/main/Assignment_14/latex.tex

1 PROBLEM

Gate Problem 20:

Let X be a random variable with probability density function

$$f(x) = \begin{cases} 0.2, & |x| \leq 1 \\ 0.1, & 1 \leq |x| \leq 4 \\ 0, & \text{otherwise} \end{cases} \quad (1.0.1)$$

The probability $Pr(0.5 < X < 5)$ is.....

2 SOLUTION

The CDF is:

$$F_X(x) = \begin{cases} 0, & x \leq -1 \\ \int_{-1}^x 0.2 dt, & |x| \leq 1 \\ \int_{-1}^1 0.2 dt + \int_1^x 0.1 dt, & 1 \leq |x| \leq 4 \\ 1, & x > 4 \end{cases} \quad (2.0.1)$$

$$= \begin{cases} 0, & x \leq -1 \\ 0.2(x+1), & |x| \leq 1 \\ 0.4 + 0.1(x-1) dt, & 1 \leq |x| \leq 4 \\ 1, & x > 4 \end{cases} \quad (2.0.2)$$

$$Pr(0.5 < X < 5) \quad (2.0.3)$$

$$= Pr(0.5 < X < 4) \quad (2.0.4)$$

$$[\because f(x) = 0 \text{ for } x \in (4, 5)] \quad (2.0.5)$$

$$= Pr(X < 4) - Pr(X \leq 0.5) \quad (2.0.6)$$

$$= F_X(4) - F_X(0.5) \quad (2.0.7)$$

$$= [0.4 + 0.1(4-1)] - [0.2(0.5+1)] \quad (2.0.8)$$

$$= 0.7 - 0.3 \quad (2.0.9)$$

$$= 0.4 \quad (2.0.10)$$

Alternatively,

$$Pr(0.5 < X < 5) \quad (2.0.11)$$

$$= \int_{0.5}^1 f(x) dx + \int_1^4 f(x) dx + \int_4^5 f(x) dx \quad (2.0.12)$$

$$= \int_{0.5}^1 0.2 dx + \int_1^4 0.1 dx + \int_4^5 0 dx \quad (2.0.13)$$

$$= 0.2 \times 0.5 + 0.1 \times 3 + 0 \quad (2.0.14)$$

$$= 0.4 \quad (2.0.15)$$

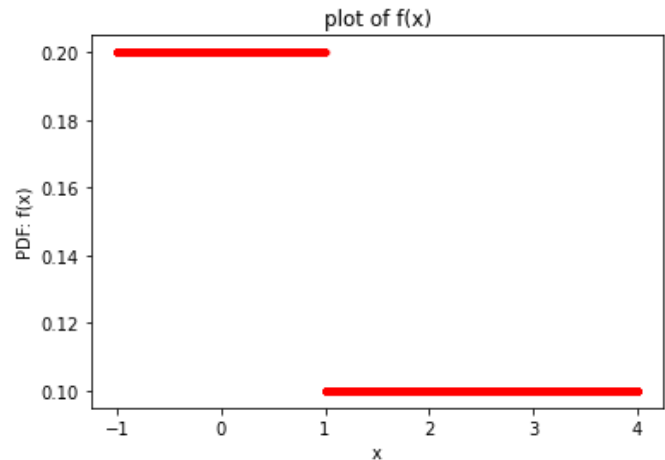


Fig. 0: PDF Plot