

Assignment 3

Tanmay Goyal - AI20BTECH11021

Download all python codes from

%%%%%%%%%

and latex-tikz codes from

%%%%%%%%%

1 PROBLEM

Let X be a random variable with a probability density function

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

Find $\Pr(0.5 \leq X \leq 5)$

2 SOLUTION

We know, if X is a continuous random variable, and its p.d.f is given by $f(x)$, then

$$\Pr(a \leq X \leq b) = \int_a^b f(x) dx \quad (2.0.1)$$

$f(x)$ is a valid p.d.f because:

1) The area under the curve of the p.d.f is 1, i.e:

$$\int_{-\infty}^{\infty} f(x) dx = 1 \quad (2.0.2)$$

2) $f(x) \geq 0$ for all $x \in \mathbb{R}$

Since $f(x)$ is a valid p.d.f, from (2.0.1), we get:

$$\begin{aligned} \Pr(0.5 \leq X \leq 5) &= \int_{0.5}^5 f(x) dx \\ &= \int_{0.5}^1 0.2 dx + \int_1^4 0.1 dx + \int_4^5 0 dx \\ & \quad (2.0.3) \end{aligned}$$

$$= 0.2(0.5) + 0.1(3) = 0.4 \quad (2.0.4)$$

The p.d.f is shown below:

