Assignment 4

Dishank Jain - AI20BTECH11011

Download all python codes from

https://github.com/Dishank422/AI1103−Probability−and−random−variables/blob/main/Assignment_4/codes

and latex-tikz codes from

https://github.com/Dishank422/AI1103−Probability−and−random−variables/blob/main/Assignment_4/main.tex

1 Problem

(Gate MA - 2016 Q.49) Let X be a standard normal random variable. Then $\Pr(X < 0 | \|\lfloor X \rfloor\| = 1)$ is equal to.....

2 Solution

Since X is standard normal random variable,

$$p_X(x) = \frac{1}{\sqrt{2\pi}} exp(\frac{-x^2}{2}) \tag{2.0.1}$$

$$\|\lfloor X \rfloor\| = 1 \tag{2.0.2}$$

$$\implies \lfloor X \rfloor = 1 \; or \; -1 \tag{2.0.3}$$

$$\implies X \in [1,2) \cup [-1,0) \tag{2.0.4}$$

Thus required probability

$$= \frac{\Pr(X \in [-1,0))}{\Pr(X \in [1,2) \cup [-1,0))} \tag{2.0.5}$$

$$= \frac{\int_{-1}^{0} \frac{1}{\sqrt{2\pi}} exp(\frac{-x^2}{2}) dx}{\int_{-1}^{0} \frac{1}{\sqrt{2\pi}} exp(\frac{-x^2}{2}) dx + \int_{1}^{2} \frac{1}{\sqrt{2\pi}} exp(\frac{-x^2}{2}) dx} \tag{2.0.6}$$

$$= \frac{\int_{-1}^{0} exp(\frac{-x^2}{2}) dx}{\int_{-1}^{0} exp(\frac{-x^2}{2}) dx + \int_{1}^{2} exp(\frac{-x^2}{2}) dx} \tag{2.0.7}$$

$$= \frac{0.86}{0.86 + 0.34} \tag{2.0.8}$$

$$= 0.716 \tag{2.0.9}$$

Disclaimer: The integration was performed using Wolfram Alpha