AI1103: Assignment 2

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Download all python codes from

https://github.com/yuvrajshekhawat1989/Assignment−2/tree/main/Codes

and latex-tikz codes from

https://github.com/yuvrajshekhawat1989/Assignment−2.git

GATE EC 2008 (PROBLEM 29)

$P_x(x) = Me^{-2|x|} + Ne^{-3|x|}$ is the probability density function for the real random variable X, Over the entire x axis. M and N are both positive real numbers. Find The equation relating M and N

SOLUTION 29

We know that $P_X(x) \geq 0$.

Theorem 1. *The integral of probability density function over the continuous random variable is equal to 1.*

$$\int_{-\infty}^{\infty} P_X(x)\,dx = 1 \tag{0.0.1}$$

$$\int_{-\infty}^{\infty} (Me^{-2|x|} + Ne^{-3|x|})\,dx = 1 \tag{0.0.2}$$

(Since this is an even function)

$$2\int_{0}^{\infty} (Me^{-2|x|} + Ne^{-3|x|})\,dx = 1 \tag{0.0.3}$$

$$2\int_{0}^{\infty} (Me^{-2x} + Ne^{-3x})\,dx = 1 \tag{0.0.4}$$

$$2(M\frac{e^{-2x}}{-2} + N\frac{e^{-3x}}{-3})\Big|_0^{\infty}\,dx = 1 \tag{0.0.5}$$

$$2(0 - (\frac{M}{-2} + \frac{N}{-3})) = 1 \tag{0.0.6}$$

$$2(\frac{M}{2} + \frac{N}{3}) = 1 \tag{0.0.7}$$

The equation when rearranged properly gives us the desired connection beteen M and N which is $M + \frac{2N}{3} = 1$