Vidyavardhini's College of Engineering and Technology

Department of Artificial Intelligence & Data Science

AY: 2024-25

Class:	TE	Semester:	V
Course Code:		Course Name:	Satats

Name of Student:	Sainath Khot
Roll No. :	20
Assignment No.:	4
Title of Assignment:	
Date of Submission:	
Date of Correction:	

Evaluation

Performance Indicator	Max. Marks	Marks Obtained
Completeness	5	
Demonstrated Knowledge	3	
Legibility	2	
Total	10	

Performance Indicator	Exceed Expectations (EE)	Meet Expectations (ME)	Below Expectations (BE)
Completeness	5	3-4	1-2
Demonstrated Knowledge Legibility	3	2	1
Legibility	2	1	0

Checked by

Name of Faculty :

Signature :

Date :

Sheet 4

Q1

a) $\int_{-\infty}^{\infty} f(x)\,dx = 1$

$\int_{0}^{\infty} f(x)\,dx = 1$

$\int_{0}^{\infty} kx^2 \cdot e^{-x}\,dx = 1$

$k\left[x^2 \cdot e^{-x} \right]_0^{\infty} + \int 2ex \cdot e^{-x}\,dx = 1$

$k\left[\int 2x \cdot e^{-x}\,dx \right] = 1$

$k\left[0 + (-2e^{-x})_0^{\infty} \right]$

$k(2) = 1$

$k = \frac{1}{2}$

b) $f(x) = \begin{cases} 1/2\, x^2 \cdot e^{-x} \\ 0 \end{cases}$

$\therefore P(x \leq 3) = \int_{-\infty}^{0} f(x)\,dx + \int_{0}^{3} f(x)\,dx$

$= \frac{1}{2} \int_{0}^{3} x \cdot e^{-x}\,dx$

$= \frac{1}{2} \left\{ \left[-x^2 e^{-x} \right]_0^3 + \left[-4x e^{-x} \right]_0^3 + \left[-2e^{-x} \right]_0^3 \right\}$

$= \frac{1}{2} \left[-9e^{-3} + (-6e^{-3} + 2 - 2e^{-3}) \right]$

$= \frac{1}{2} \left[-17 e^{-3} \right]$

$= \frac{1}{2} \left[-17 \times 0.04979 \right]$

$= 0.577$

Q.

=) for a continuous random variable

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

$$\int_{-\infty}^{0} f(x)\,dx + \int_{0}^{\pi} f(x)\,dx + \int_{\pi}^{\infty} f(x)\,dx = 1$$

$$\therefore \int_{0}^{\pi} f(x) = 1$$

$$\therefore \int_{0}^{\pi} k \cdot e^{-x} (\sin(x)) = 1$$

$$\therefore k \int_{0}^{\pi} e^{-x} \sin(x) = 1$$

$$= k \left\{ -e^{-x} \sin(x) \right]_{0}^{\pi} + \int_{0}^{\pi} e^{-x} (\cos(x)\,dx) \right\}$$

$$= k \left\{ \left[e^{-x} \cos(x) \right]_{0}^{\pi} + \int_{0}^{\pi} e^{-x} \cos x (x)\,dx \right\}$$

$$= k \left\{ \left(e^{x} (0) x \right)_{0}^{\pi} - \int_{0}^{\pi} e^{-x} \sin(x)\, dx \right\}_{0}^{\pi}$$

Let $\int_0^{\pi} e^{-x} \sin(x)\, dx = I$ which was integral

$$(I) = (e^{-\pi} + 1) 0 - I$$

$$2I = e^{-\pi} + 1$$

$$I = \frac{e^{-\pi} + 1}{2}$$

$$\therefore \int_0^{\pi} e^{-x} (\sin(x))\, dx = \frac{e^{-\pi} + 1}{2}$$

Now for k

$$k \cdot \frac{e^{-\pi} + 1}{2} = 1$$

$$k = \frac{2}{e^{-\pi} + 1} \approx 1.917$$

$$\therefore k = 1.917$$