

Assignment5

CS20Btech11035 -NYALAPOGULA MANASWINI

Download python code from

<https://github.com/N-Manaswini23/assignment5/blob/main/assignment5.py>

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Substituting values in table(0) in (0.0.6) we get

$$E(XY) = \frac{3}{8} \quad (0.0.7)$$

$$\therefore 8E(XY) = 3 \quad (0.0.8)$$

GATE 2021 ST QUESTION 44

Let (X, Y) have a bivariate normal distribution with the joint probability density function

$$f_{X,Y}(x, y) = \frac{1}{\pi} e^{(\frac{3}{2}xy - \frac{25}{32}x^2 - 2y^2)} \quad (0.0.1)$$

$$-\infty < x, y < \infty \quad (0.0.2)$$

Then $E(XY)$ equals

SOLUTION

Given probability density function for (X, Y)

$$f_{X,Y}(x, y) = \frac{1}{\pi} e^{(\frac{3}{2}xy - \frac{25}{32}x^2 - 2y^2)} \quad (0.0.3)$$

$$-\infty < x, y < \infty \quad (0.0.4)$$

Joint pdf of bivariate normal distribution $N(\mu_x, \mu_y, \sigma_x^2, \sigma_y^2, \rho)$ is

$$f_{X,Y}(x, y) = \frac{1}{2\pi\sigma_x\sigma_y\sqrt{1-\rho^2}} \times e^{\frac{-1}{2(1-\rho^2)} \left[\left[\frac{(x-\mu_x)}{\sigma_x} \right]^2 + \left[\frac{(y-\mu_y)}{\sigma_y} \right]^2 - 2\rho \left[\frac{(x-\mu_x)}{\sigma_x} \frac{(y-\mu_y)}{\sigma_y} \right] \right]} \quad (0.0.5)$$

Comparing (0.0.5) and (0.0.3) we get

μ_x	μ_y	σ_x	σ_y	ρ
0	0	1	$\frac{5}{8}$	$\frac{3}{5}$

TABLE 0: Table 1

We need to find $E(XY)$

$$E(XY) = \rho\sigma_x\sigma_y + \mu_x\mu_y \quad (0.0.6)$$