Finding E(XY) for joint probability density

Asked 5 months ago Modified 5 months ago Viewed 106 times

1

$Joint\ probability\ f(x,y) = 2/3\ for\ 0 < x < 1, 0 < y < 2, x < y, and\ 0\ otherwise$

$E(XY) = \int_0^1 \int_x^2 \frac{2}{3}xy\,dy\,dx = \frac{7}{12} - (1)$

$E(XY) = \int_0^2 \int_0^y \frac{2}{3}xy\,dx\,dy = \frac{4}{3} - (2)$

Hello, I am quite new on multivariable calculus so I am a little unsure why the answers for eqn (1) and (2) are different.

From what I recalled from class, there is no difference if we integrate w.r.t x or y first. So I suspect that the limits of my integration for eqn (2) is wrong.

So I am wondering if there is an easy way to correctly remember what are the limits of integration for these types of questions and how would I find E(XY) if I were to integrate w.r.t x first?

Edit: Missed out the xy in the integrals

probability integral calculus

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edited Mar 28 at 8:35

asked Mar 28 at 6:06
Grey Han
45 3

are you sure this is the right way for calculating means ? Should you not integrate xyf(x,y) over the whole domain ? – MrSmithGoesToWashington Mar 28 at 7:51

1 Answer

Sorted by: Highest score (default)

0

The second integral should be written as two summands:

$$E[XY] = \int_0^1 \int_0^y \frac{2}{3}xydxdy + \int_1^2 \int_0^1 \frac{2}{3}xydxdy$$

You can see this by drawing the support region of $f(x,y)$. It's bounded by $x = y$, $x = 0$, $x = 1$ and $y = 2$ lines. When $y < 1$, x starts from 0 and ends at y. When $y > 1$, x should end at 1 (instead of y) because y is greater than 1.

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answered Mar 28 at 7:48
gunes
52.9k 4 43 80