theoretical joint distributions

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For two continuous random variables, we can write their joint pdf the same way: $f(x, y)$

"summing" the small bits of probability $f(x, y)dxdy$ over some region $X \in A, Y \in B$

Let X, Y be a continuous random variables. The joint pdf for X and Y is $f(x, y) \geq 0$

The joint range is the set of pairs (x, y) that have non-zero density.

The double integral over all values must be 1

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

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exercise 4

Let X and Y be two jointly continuous random variables with the following joint pdf

$$f(x,y) = \begin{cases} x + cy^2 & \text{for } 0 \le x \le 1, 0 \le y \le 1 \\ 0 & \text{otherwise} \end{cases}$$

(a) Find a sketch the joint range of X and Y (i.e. $\Omega_{X,Y}$).

(b) Find the constant c that makes $f(x, y)$ a valid joint pdf.

(c) Find $P(0 \le X \le 1/2,\ 0 \le Y \le 1/2)$.