⟨discrete⟩

Joint pmf

$$p_{X_1, X_2}(x_1, x_2) = P[X_1 = x_1, X_2 = x_2]$$

$$(x_1, x_2) \in D$$

Properties:

(i) $0 \le p_{X_1 X_2}(x_1, x_2) \le 1$

(ii) $\sum_D \sum p_{X_1 X_2}(x_1, x_2) = 1 \Leftrightarrow \sum_{x_2} \sum_{x_1} p(x_1, x_2) = 1$

$$\boxed{P[(X_1, X_2) \in B] = \sum_B \sum p_{X_1, X_2}(x_1, x_2)}$$

⟨continuous⟩

Joint pdf

$$\frac{\partial^2 F_{X_1 X_2}(x_1, x_2)}{\partial x_1 \partial x_2} = f_{X_1, X_2}(x_1, x_2)$$

properties:

(i) $f_{X_1, X_2}(x_1, x_2) \ge 0$

$f_{X_1, X_2}(x_1, x_2)$ 아래의 부피

(ii) $\iint_D f_{X_1, X_2}(x_1, x_2) dx_1 dx_2 = 1 \Leftrightarrow \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} f(x_1, x_2) dx_1 dx_2 = 1$

$$\boxed{P[(X_1, X_2) \in A] = \iint_A f_{X_1, X_2}(x_1, x_2) dx_1 dx_2}$$