2 RVs:

Joint PMF: $P_{X,Y}(x, y) = P[X = x, Y = y]$

Joint PDF: $f_{X,Y}(x, y) = \frac{\partial^2}{\partial x \partial y} F_{X,Y}(x, y)$

*$P[(X, Y) \in A] = \int \int_{(x,y) \in A} f_{X,Y}(x, y)\, dx\, dy$

Expectation: $E[g(X, Y)] = \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} g(x, y) f_{X,Y}(x, y)\, dx\, dy$

Correlation: $E[XY]$

Covariance: $\mathrm{Cov}[X, Y] = E[XY] - E[X]E[Y]$

Correlation Coefficient: $\rho_{X,Y} = \frac{\mathrm{Cov}[X,Y]}{\sigma_X \sigma_Y}$

Bayes' Rule $f_{Y|X}(y|x) = \frac{f_{X,Y}(x,y)}{f_X(x)} = \frac{f_{X|Y}(x|y) f_Y(y)}{\int_{-\infty}^{\infty} f_{X|Y}(x|y') f_Y(y')\, dy'}$

Independent: $f_{X|Y}(x|y) = f_X(x)\ \forall y \Leftrightarrow f_{X,Y}(x, y) = f_X(x) f_Y(y)$

*If independent, then uncorrelated.

Uncorrelated: $\mathrm{Cov}[X, Y] = 0 \Leftrightarrow \rho_{X,Y} = 0$

Orthogonal: $E[XY] = 0$

Conditional Expectation: $E[Y] = E[E[Y|X]]$ or $E[E[h(Y)|X]]$

*$E[E[Y|X]]$ w.r.t. X | $E[Y|X]$ w.r.t. Y.