

Lecture 3 — Multiple Random Variables

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- The Law of Total Expectation

$$E[Y] = E_X[E[Y|X]]$$

- The Law of Total Variance

$$\text{Var}[Y] = E_X[\text{Var}[Y|X]] + \text{Var}_X[E[Y|X]]$$

- For joint random variables, we know:

- $F_{XY}(x, y) = \int_{-\infty}^y \int_{-\infty}^x f_{XY}(x, y) dx dy$
- $F_{XY}(\infty, \infty) = 1$
- $F_{XY}(x, \infty)$ represents the marginal CDF of X , $F_X(x)$
- $F_{XY}(\infty, y)$ represents the marginal CDF of Y , $F_Y(y)$