

Expected Value and Variance Formulas

$$1. E(X) = \begin{cases} \sum_x x p_X(x) & \text{if } X \text{ is discrete} \\ \int_{-\infty}^{\infty} x f_X(x) dx & \text{if } X \text{ is continuous} \end{cases}$$

$$2. E[g(X)] = \begin{cases} \sum_x g(x) p_X(x) & \text{if } X \text{ is discrete} \\ \int_{-\infty}^{\infty} g(x) f_X(x) dx & \text{if } X \text{ is continuous} \end{cases}$$

$$3. E[g(X,Y)] = \begin{cases} \sum_x g(x,y) p_{X,Y}(x,y) & \text{if } X,Y \text{ are discrete} \\ \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} g(x,y) f_{X,Y}(x,y) dy dx & \text{if } X,Y \text{ are continuous} \end{cases}$$

$$4. \text{Var } X = E[(X - \mu_X)^2] = E(X^2) - \mu_X^2$$

$$\text{Var } g(X) = E[(g(X) - \mu_{g(X)})^2] = E[g(X)^2] - \mu_{g(X)}^2$$

$$\text{Var } g(X,Y) = E[\{g(X,Y) - \mu_{g(X,Y)}\}^2] = E[\{g(X,Y)\}^2] - \mu_{g(X,Y)}^2$$