Misc. Variance

$$\text{Sample}: \quad \sigma_S^2 = \frac{\sum_i (x_i - \overline{x})^2}{n-1}$$

$$\text{Chain Rule}: \quad \sigma_z^2 = \sum_i \left(\frac{\partial z}{\partial \overline{x}_i}\right)^2 \sigma_i^2$$

Variance By Correlation

$$\text{Correlated Sum}: \quad \sigma_{A+B}^2 = \sigma_A^2 + \sigma_B^2 + 2(\overline{x}_{AB} - \overline{x}_A \; \overline{x}_B)$$

$$\text{Uncorrelated Sum}: \quad \sigma^2 = \textstyle\sum_i \sigma_i^2$$

$$\text{[Correlated] Multiple}: \quad \sigma_{nA}^2 = n^2 \sigma_A^2$$

Weighted Averages:

$$\text{Variance}: \quad \sigma_W^2 = \frac{1}{\sum_i \left(1/\sigma_i^2\right)} \qquad \text{Average}: \quad X_W = \frac{\sum_i x_i \left(1/\sigma_i^2\right)}{\sum_i \left(1/\sigma_i^2\right)} = \frac{\sum_i x_i \left(1/\sigma_i^2\right)}{\sigma_W^2}$$

X% Uncertainty: $\quad X = \dfrac{\sigma}{\bar{\mu}}$

Poisson Distribution

$$\boxed{P(n) = \left(\frac{\lambda^n}{n!}\right) e^{-\lambda}}$$

- $\lambda = \mu_n = \sigma_n^2 =$ average counts-per-time rate
- $\sigma_{n=N} \approx \sqrt{N}$ for large $n = N > 20$

Exponential Distribution

$$\boxed{P(t) = \lambda e^{-\lambda t}}$$

- $\mu_t = 1/\lambda =$ average waiting time for next count in Poisson Dist. λ
- $\sigma_t = 1/\lambda^2$