Binomial Probability Distribution

$$P(x=k)=C_k^n p^k q^{n-k}=\frac{n!}{k!(n-k)!}p^k q^{n-k}$$

$$\text{Mean}: \mu = np$$

$$\text{Variance}: \sigma^2 = npq$$

$$\text{Standard deviation}: \sigma = \sqrt{npq}$$

Hypergeometric Probability Distribution

$$P(x=k)=\frac{C_k^M C_{n-k}^{N-M}}{C_n^N}$$

M → successes, ***N-M*** → failures,
n → size of the random sample space

$$\text{Mean}: \mu = n\left(\frac{M}{N}\right)$$

$$\text{Variance}: \sigma^2 = n\left(\frac{M}{N}\right)\left(\frac{N-M}{N}\right)\left(\frac{N-n}{N-1}\right)$$

Poisson Probability Distribution

$$P(x=k)=\frac{\mu^k e^{-\mu}}{k!}$$

Mean: $E(x) = \mu$

$$\text{Variance}: \sigma^2 = \mu$$

Standard deviation: $\sigma = \sqrt{\mu}$

Variance of a Sample

$$s^2 = \frac{\sum(x_i-\bar{x})^2}{n-1} = \frac{\sum x_i^2 - \frac{(\sum x_i)^2}{n}}{n-1}$$

Variance of Population: $\sigma^2 = \dfrac{\sum(x_i-\mu)^2}{N}$

Correlation coefficient, $r = \dfrac{s_{xy}}{s_x s_y}$

Covariance, $s_{xy} = \dfrac{\sum(x_i-\bar{x})(y_i-\bar{y})}{n-1}$, or

$$s_{xy} = \frac{\sum x_i y_i - \frac{(\sum x_i)(\sum y_i)}{n}}{n-1}$$

Regression line, $y = a + bx$

$$b = r\frac{s_y}{s_x} \quad , \quad a = \bar{y} - b\bar{x}$$

Normal Distribution, N(μ, σ²)

$$f(x)=\frac{1}{\sigma\sqrt{2\pi}}e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2} \quad \text{for } -\infty < x < \infty$$

$$P(a<X<b)=\int_b^a f(x)\,dx$$

Standardizing the value of x :

$z = \dfrac{x-\mu}{\sigma}$, or in a sample, $z = \dfrac{x-\bar{x}}{s}$