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: $\sigma^2=\frac{\sum(x_i-\mu)^2}{N}$

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

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

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

Regression line, $y = a + bx$

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

Standardizing the value of x :

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