$$s_x^2 = \frac{\sum_{i=1}^{N}(X_i - \bar{X})^2}{N-1}$$

$$s_{xy} = \frac{\sum_{i=1}^{N}\{(X_i - \bar{X})(Y_i - \bar{Y})\}}{N-1}$$

$$r_{xy} = \frac{s_{xy}}{s_x s_y}$$

$$\mu = \sum_x x f(x)$$

$$\sigma^2 = \sum_x (x-\mu)^2 f(x)$$

$$\sigma^2 = E(X^2) - [E(X)]^2$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

$$P(A \cap B) = P(A|B)P(B)$$

$$A \cap B = B \cap A$$

$$? \overset{approx}{\sim} \mathcal{N}\left(\mu, \frac{\sigma^2}{N}\right)$$

$$? \overset{approx}{\sim} \mathcal{N}\left(p, \frac{p(1-p)}{N}\right)$$

$$\bar{X} \pm z_{\alpha/2} \times \frac{\sigma}{\sqrt{N}}$$

$$\bar{X} \pm t_{\alpha/2} \times \frac{s}{\sqrt{N}}$$

$z_{\alpha/2}$ is the value such that $P(Z > z_{\alpha/2}) = \alpha/2$

z_{α} is the value such that $P(Z > z_{\alpha}) = \alpha$

$t_{\alpha/2}$ is the value such that $P(T > t_{\alpha/2}) = \alpha/2$

t_{α} is the value such that $P(T > t_{\alpha}) = \alpha$

The followings are for ? distribution:

$$
\begin{aligned}
f(x) &= \binom{n}{x} p^x (1-p)^{n-x} \\
E(X) &= np \\
Var(X) &= np(1-p) \\
\binom{n}{x} &= \frac{n!}{x!(n-x)!} \\
0! &= 1 \\
n! &= 1 \times 2 \times 3 \times \ldots \times n
\end{aligned}
$$

The following is for ? distribution:

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

The following is for ? distribution:

$$
\begin{aligned}
f(x) &= \begin{cases} \frac{1}{b-a} & \text{for } a \le x \le b \\ 0 & \text{otherwise,} \end{cases} \\
Var(X) &= \frac{(b-a)^2}{12}
\end{aligned}
$$

The following is for ? distribution:

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

The following is for ? distribution:

$$f(z) = \frac{1}{\sqrt{2\pi}} e^{-\left(\frac{1}{2}\right)z^2}$$