FORMULE

$$\overline{X}=\frac{\sum X}{n} \qquad M_e=\begin{cases} X_{\frac{n+1}{2}} \\ \dfrac{X_{\frac{n}{2}}+X_{\frac{n}{2}+1}}{2} \end{cases}$$

$$\overline{X}=\frac{\sum fX}{\sum f} \qquad M_e=L+\frac{\frac{n}{2}-F_{M_e-1}}{f_{M_e}}\cdot i \qquad M_o=L+\frac{d_1}{d_1+d_2}\cdot i$$

$$Y=X-C \qquad \overline{Y}=\overline{X}-C \qquad \overline{X}=\overline{Y}+C \qquad d=\frac{X-C}{i} \qquad \overline{X}=i\cdot\overline{d}+C$$

$$G=\sqrt[n]{X_1\cdot X_2\cdot\ldots\cdot X_n} \quad X_i>0 \ (i=1,\ldots,n) \qquad G=\sqrt[\sum f]{X_1^{f_1}\cdot X_2^{f_2}\cdot\ldots\cdot X_k^{f_k}} \quad X_i>0 \ (i=1,\ldots,k)$$

$$p=(G-1)\cdot 100\ (\%)$$

$$H=\frac{n}{\sum_{i=1}^{n}\frac{1}{X_i}} \quad X_i\neq 0 (i=1,\ldots,n) \qquad H=\frac{\sum_{i=1}^{k} f_i}{\sum_{i=1}^{k}\frac{f_i}{X_i}} \quad X_i\neq 0 (i=1,\ldots,k)$$

$$I=X_{max}-X_{min} \qquad IQR=Q_3-Q_1 \qquad V_Q=\frac{Q_3-Q_1}{Q_1+Q_3}\cdot 100(\%) \qquad S_o=\frac{\sum\left|X-\overline{X}\right|}{n}$$

$$\sigma^2=\frac{\sum\left(X-\overline{X}\right)^2}{n} \qquad \sigma^2=\frac{\sum X^2-\frac{\left(\sum X\right)^2}{n}}{n} \qquad \sigma=\sqrt{\sigma^2} \qquad V=\frac{\sigma}{\overline{X}}\cdot 100(\%) \qquad Z=\frac{X-\overline{X}}{\sigma}$$

$$S_0=\frac{\sum f\left|X-\overline{X}\right|}{\sum f} \qquad \sigma^2=\frac{\sum f(X-\overline{X})^2}{\sum f} \qquad \sigma^2=\frac{\sum fX^2-\frac{\left(\sum fX\right)^2}{\sum f}}{\sum f} \qquad \sigma_X^2=i^2\sigma_d^2=i^2\cdot\frac{\sum fd^2-\frac{\left(\sum fd\right)^2}{\sum f}}{\sum f}$$

$$Q_1=\begin{cases} X_{\left[\frac{n}{4}\right]+1} \\ \dfrac{X_{\frac{n}{4}}+X_{\frac{n}{4}+1}}{2} \end{cases} \qquad Q_3=\begin{cases} X_{\left[3\cdot\frac{n}{4}\right]+1} \\ \dfrac{X_{3\cdot\frac{n}{4}}+X_{3\cdot\frac{n}{4}+1}}{2} \end{cases}$$

$$Q_1=L+\frac{\frac{n}{4}-F_{Q_1-1}}{f_{Q_1}}\cdot i \qquad Q_3=L+\frac{3\cdot\frac{n}{4}-F_{Q_3-1}}{f_{Q_3}}\cdot i$$

$$\mu_2=\frac{\sum(X-\overline{X})^2}{n} \qquad \mu_3=\frac{\sum(X-\overline{X})^3}{n} \qquad \mu_4=\frac{\sum(X-\overline{X})^4}{n}$$

$$\mu_2=\frac{\sum f(X-\overline{X})^2}{n}\qquad \mu_3=\frac{\sum f(X-\overline{X})^3}{n}\qquad \mu_4=\frac{\sum f(X-\overline{X})^4}{n}\qquad n=\sum f$$

$$s_i=\sum fd^i\,(i=1,2,3,4)\qquad d=\frac{X-c}{i}$$

$$\mu_2=i^2\frac{s_2-\frac{s_1^2}{n}}{n}\qquad \mu_3=i^3\frac{s_3-\frac{3}{n}s_1s_2+\frac{2}{n^2}s_1^3}{n}\qquad \mu_4=i^4\frac{s_4-\frac{4}{n}s_1s_3+\frac{6}{n^2}s_1^2s_2-\frac{3}{n^3}s_1^4}{n}$$

$$\beta_1=\frac{\mu_3^2}{\mu_2^3}\qquad \alpha_3=\sqrt{\beta_1}\qquad \beta_2=\frac{\mu_4}{\mu_2^2}$$

$$\boxed{p_i=P(X=i)=\binom{n}{i}\cdot p^i\cdot q^{n-i}\,(i=0,1,2..,n)\qquad \binom{n}{i}=\frac{n(n-1)..\cdot..(n-i+1)}{n!}}\qquad \frac{p_{i+1}}{p_i}=\frac{n-i}{i+1}\cdot\frac{p}{q}$$

1. $\sum_{i=0}^{n}p_i=1$
2. $\mu=E(X)=np$
3. $\sigma^2=n\cdot p\cdot q$
4. $\mu_3=npq(q-p)$
5. $\beta_1=\frac{(q-p)^2}{npq}$
6. $\beta_2=3+\frac{1-6pq}{npq}$
7. $V=\sqrt{\frac{q}{np}}\cdot 100(\%)$
8. Modus $\quad (n+1)p-1\le M_0\le(n+1)p$

$$\boxed{p_i=P(X=i)=\frac{e^{-m}m^i}{i!}(i=0,1,2......),\ e=2{,}71828.}\qquad p_{i+1}=p_i\cdot\frac{m}{i+1}$$

1. $\sum_{i=0}^{+\infty}p_i=1$
2. $\mu=E(X)=m$
3. $\sigma^2=m$
4. $\mu_3=m$
5. $\beta_1=\frac{1}{m}$
6. $\beta_2=3+\frac{1}{m}$
7. $V=\frac{1}{\sqrt{m}}\cdot 100(\%)$
8. Modus $\quad m-1\le M_0\le m$

$$\mu = \frac{\sum X}{N} \qquad \overline{X} = \frac{\sum \overline{X}_i}{k} \qquad k = \binom{N}{n} \qquad k = N^n \qquad \sigma^2 = \frac{\sum (X-\mu)^2}{N} \qquad \sigma^2_{\overline{X}} = \frac{\sum (\overline{X}_i - \mu)^2}{k}$$

$$\sigma^2_{\overline{X}} = \frac{\sigma^2}{n} \cdot \frac{N-n}{N-1} \qquad \sigma^2_{\overline{X}} = \frac{\sigma^2}{n} \qquad \sigma_{\overline{X}} = \sqrt{\sigma^2_{\overline{X}}} \qquad \overline{X} \sim N(\mu, \sigma_{\overline{X}})$$

$$\overline{X} - z_\alpha \sigma_{\overline{X}} < \mu < \overline{X} + z_\alpha \sigma_{\overline{X}} \qquad d = z_\alpha \cdot \sigma_{\overline{X}}$$

$$s^2 = \frac{\sum (X-\overline{X})^2}{n-1} \qquad s^2 = \frac{\sum X^2 - \frac{(\sum X)^2}{n}}{n-1} \qquad s^2 = \frac{\sum f(X-\overline{X})^2}{n-1} \qquad s^2 = \frac{\sum fX^2 - \frac{(\sum fX)^2}{n}}{n-1}$$

$$s_{\overline{X}} = \sqrt{\frac{\sum X^2 - \frac{(\sum X)^2}{n}}{n(n-1)} \cdot \frac{N-n}{N}} \qquad s_{\overline{X}} = \sqrt{\frac{\sum X^2 - \frac{(\sum X)^2}{n}}{n(n-1)}}$$

$$s_{\overline{X}} = \sqrt{\frac{\sum (X-\overline{X})^2}{n(n-1)} \cdot \frac{N-n}{N}} \qquad s_{\overline{X}} = \sqrt{\frac{\sum (X-\overline{X})^2}{n(n-1)}}$$

$$s_{\overline{X}} = \sqrt{\frac{\sum fX^2 - \frac{(\sum fX)^2}{n}}{n(n-1)} \cdot \frac{N-n}{N}} \qquad s_{\overline{X}} = \sqrt{\frac{\sum fX^2 - \frac{(\sum fX)^2}{n}}{n(n-1)}} \qquad n = \sum f$$

$$s_{\overline{X}} = \sqrt{\frac{\sum f(X-\overline{X})^2}{n(n-1)} \cdot \frac{N-n}{N}} \qquad s_{\overline{X}} = \sqrt{\frac{\sum f(X-\overline{X})^2}{n(n-1)}}$$

$$\overline{X} - t_{n-1;\alpha} \cdot s_{\overline{X}} < \mu < \overline{X} + t_{n-1;\alpha} \cdot s_{\overline{X}} \qquad d = t_{n-1;\alpha} \cdot s_{\overline{X}}$$

$$\hat{p} = \frac{a}{n} \quad \hat{q} = 1 - \hat{p} \qquad s_{\hat{p}} = \begin{cases} \sqrt{\frac{\hat{p} \cdot \hat{q}}{n-1} \cdot \frac{N-n}{N}} \approx \sqrt{\frac{\hat{p} \cdot \hat{q}}{n} \cdot \frac{N-n}{N}} \\ \sqrt{\frac{\hat{p} \cdot \hat{q}}{n-1}} \approx \sqrt{\frac{\hat{p} \cdot \hat{q}}{n}} \end{cases}$$

$$\hat{p} - z_\alpha \cdot s_{\hat{p}} < p < \hat{p} + z_\alpha \cdot s_{\hat{p}} \qquad d = z_\alpha \cdot s_{\hat{p}}$$

$$Z = \frac{\overline{X} - \mu_0}{\sigma_{\overline{X}}} \qquad t = \frac{\overline{X} - \mu_0}{s_{\overline{X}}} \qquad Z = \frac{\hat{p} - p_0}{s_{\hat{p}}} \qquad s_{\hat{p}} = \sqrt{\frac{\hat{p} \cdot \hat{q}}{n}} \qquad Z = \frac{\hat{p} - p_0}{\sigma_{\hat{p}}} \qquad \sigma_{\hat{p}} = \sqrt{\frac{p_0 \cdot q_0}{n}}$$

$$Z = \frac{\overline{X}_1 - \overline{X}_2}{\sigma_{\overline{X}_1 - \overline{X}_2}} \qquad \sigma_{\overline{X}_1 - \overline{X}_2} = \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

$$\overline{X}_1-\overline{X}_2-z_\alpha\cdot\sigma_{\overline{X}_1-\overline{X}_2}<\mu_1-\mu_2<\overline{X}_1-\overline{X}_2+z_\alpha\cdot\sigma_{\overline{X}_1-\overline{X}_2}$$

$$s_{1+2}^2=\frac{\sum X_1^2-\frac{(\sum X_1)^2}{n_1}+\sum X_2^2-\frac{(\sum X_2)^2}{n_2}}{n_1+n_2-2}\qquad s_{1+2}^2=\frac{\sum(X_1-\overline{X}_1)^2+\sum(X_2-\overline{X}_2)^2}{n_1+n_2-2}$$

$$s_{1+2}^2=\frac{\sum f_1X_1^2-\frac{(\sum f_1X_1)^2}{n_1}+\sum f_2X_2^2-\frac{(\sum f_2X_2)^2}{n_2}}{n_1+n_2-2}$$

$$s_{1+2}^2=\frac{\sum f_1(X_1-\overline{X}_1)^2+\sum f_1(X_2-\overline{X}_2)^2}{n_1+n_2-2}$$

$$s_{1+2}^2=\frac{(n_1-1)\cdot s_1^2+(n_2-1)\cdot s_2^2}{n_1+n_2-2}\qquad s_{(\overline{X}_1-\overline{X}_2)}=\sqrt{s_{1+2}^2\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}\qquad t=\frac{\overline{X}_1-\overline{X}_2}{s_{(\overline{X}_1-\overline{X}_2)}}$$

$$\overline{X}_1-\overline{X}_2-t_{n_1+n_2-2;\alpha}\cdot s_{\overline{X}_1-\overline{X}_2}<\mu_1-\mu_2<\overline{X}_1-\overline{X}_2+t_{n_1+n_2-2;\alpha}\cdot s_{\overline{X}_1-\overline{X}_2}$$

$$\hat{p}_1=\frac{a_1}{n_1}\qquad \hat{p}_2=\frac{a_2}{n_2}\qquad \hat{q}_1=1-\hat{p}_1\qquad \hat{q}_2=1-\hat{p}_2\qquad \overline{p}=\frac{a_1+a_2}{n_1+n_2}\qquad \overline{q}=1-\overline{p}$$

$$s_{(\hat{p}_1-\hat{p}_2)}=\sqrt{\overline{p}\overline{q}\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}\qquad Z=\frac{\hat{p}_1-\hat{p}_2}{s_{(\hat{p}_1-\hat{p}_2)}}$$

$$\hat{p}_1-\hat{p}_2-z_\alpha\cdot s_{(\hat{p}_1-\hat{p}_2)}<p_1-p_2<\hat{p}_1-\hat{p}_2+z_\alpha\cdot s_{(\hat{p}_1-\hat{p}_2)}$$

$$Q=\sum_{i=1}^{k}\sum_{j=1}^{n_i}X_{ij}^2-C\qquad T=\sum_{i=1}^{k}T_i\qquad T_i=\sum_{j=1}^{n_i}X_{ij}\qquad N=\sum_{i=1}^{k}n_i\qquad N=n\cdot k\qquad C=\frac{T^2}{N}$$

$$\overline{x}_i=\frac{T_i}{n_i}\qquad Q_T=\sum_{i=1}^{k}\frac{T_i^2}{n_i}-C\qquad Q_P=Q-Q_T\qquad \overline{X}_i=\frac{T_i}{n_i}\qquad F=\frac{\frac{Q_T}{k-1}}{\frac{Q_P}{N-k}}=\frac{s_T^2}{s_P^2}$$

$$s_P^2=\frac{(n_1-1)\cdot s_1^2+(n_2-1)\cdot s_2^2+...+(n_k-1)\cdot s_k^2}{N-k}$$

$$t=\frac{\overline{X}_i-\overline{X}_j}{s_{(\overline{X}_i-\overline{X}_j)}}\qquad s_{(\overline{X}_i-\overline{X}_j)}=\sqrt{s_P^2\left(\frac{1}{n_i}+\frac{1}{n_j}\right)}\qquad s_{(\overline{X}_i-\overline{X}_j)}=\sqrt{\frac{2\cdot s_P^2}{n}}\qquad s_{\overline{X}}=\sqrt{\frac{s_P^2}{n}}$$

$$NZR_{N-k;\alpha}=t_{N-k;\alpha}\cdot s_{\overline{x}_i-\overline{x}_j}$$

$$b = \frac{\sum(X-\overline{X})(Y-\overline{Y})}{\sum(X-\overline{X})^2} \qquad b = \frac{\sum XY - \frac{(\sum X \sum Y)}{n}}{\sum X^2 - \frac{(\sum X)^2}{n}} \qquad a = \overline{Y} - b\overline{X}$$

$$s_e = \sqrt{\frac{\sum(Y-\hat{Y})^2}{n-2}} \qquad s_e = \sqrt{\frac{\sum Y^2 - a\sum Y - b\sum XY}{n-2}}$$

$$Q = \sum(Y-\overline{Y})^2 \qquad Q = \sum Y^2 - \frac{(\sum Y)^2}{n}$$

$$Q_R = \frac{\left[\sum(X-\overline{X})(Y-\overline{Y})\right]^2}{\sum(X-\overline{X})^2} \qquad Q_R = \frac{\left[\sum XY - \frac{(\sum X \sum Y)}{n}\right]^2}{\sum X^2 - \frac{(\sum X)^2}{n}} \qquad Q_{VR} = Q - Q_R$$

$$Q_{VR} = \sum(Y-\hat{Y})^2 \qquad s_e = \sqrt{\frac{Q_{VR}}{n-2}} \qquad s_e^2 = \frac{Q_{VR}}{n-2}$$

$$F = \frac{Q_R}{\frac{Q_{VR}}{n-2}} = \frac{s_R^2}{s_e^2} \qquad t = \frac{b}{s_b} \qquad s_b = \sqrt{\frac{s_e^2}{\sum(X-\overline{X})^2}} \qquad s_b = \sqrt{\frac{s_e^2}{\sum X^2 - \frac{(\sum X)^2}{n}}}$$

$$b - t_{n-2;\alpha} \cdot s_b < \beta < b + t_{n-2;\alpha} \cdot s_b$$

$$r = \frac{\sum\left(X-\overline{X}\right)\left(Y-\overline{Y}\right)}{\sqrt{\sum\left(X-\overline{X}\right)^2 \sum\left(Y-\overline{Y}\right)^2}} \qquad r = \frac{\sum XY - \frac{(\sum X \sum Y)}{n}}{\sqrt{\left[\sum X^2 - \frac{(\sum X)^2}{n}\right] \cdot \left[\sum Y^2 - \frac{(\sum Y)^2}{n}\right]}}$$

$$r^2 = \frac{Q_R}{Q} \qquad t = \frac{r}{s_r} \qquad s_r = \sqrt{\frac{1-r^2}{n-2}} \qquad F = \frac{r^2}{1-r^2} \cdot (n-2)$$