FORMULAS

$P(A\cup B)=P(A)+P(B)-P(AB);\quad P(A/B)=\dfrac{P(AB)}{P(B)};\ P(E_i/F)=\dfrac{P(F/E_i)P(E_i)}{\sum_{j=1}^{k}P(F/E_j)P(E_j)};\ \overline{A\cup B}=\bar{A}\,\bar{B};\ \bar{A}\cup\bar{B}=\overline{A\,B}$

$E(X)=\mu_X(x)=\int_{-\infty}^{\infty}x\,f_X(x)\,dx\quad(\text{or}\ \sum_{\text{for all }x}x_i\ p(x_i));\ E(g(x))\cong g(\mu_X);\ E(a)=a;\ E(x+a)=E(x)+a;\ E(ax)=aE(x)$

$E(x^2)=\int_{-\infty}^{\infty}x^2\,f_X(x)\,dx\ \ (\text{or}\ \sum_{\text{for all }x}x^2{}_i P_X(x_i));\ V(x)=E(x^2)-(E(x))^2=E(x^2)-\mu_X^2;\quad \delta=\dfrac{\sigma}{\mu}$

$V(X)=\sigma^2=\int_{-\infty}^{\infty}(x-\mu_X)^2 f_X(x)\,dx\ \ (\text{or}\ \sum_{\text{for all }x_i}(x_i-\mu_X)^2 p_X(x_i));\ V(a)=0;\ V(a+x)=V(x);\ V(ax)=a^2V(x);$

$F_X(x)=P(X\le x)\Rightarrow F_X(x)=\sum_{x_{min}}^{x}P_X(x_i)\quad\text{or}\ F_X(x)=\int_{-\infty}^{x}f_X(x)\,dx$

$f_X(x)=\int f_{XY}(x,y)\,dy\quad(\text{or}\sum_{\forall y}P_{XY}(x,y));\ f_Y(y)=\int f_{XY}(x,y)\,dx\quad(\text{or}\sum_{\forall x}P_{XY}(x,y))$

$f_{X/Y}(x/y)=\dfrac{f_{XY}(x,y)}{f_Y(y)};\ E(XY)=\iint xy\,f_{XY}(x,y)\,dx\,dy\ (\text{or}\ (\sum\sum x_i y_j P_{XY}(x_i,y_j))$

$COV(XY)=E(XY)-E(X).\,E(Y);\ \rho_{XY}=\dfrac{COV(XY)}{\sigma_X\sigma_Y};\ E(X/Y)=\int x\,f_{X/Y}(x/y)dx\ \ (\text{or}\sum x\,P_{X/Y}(x/y));$

$E(aX\pm bY\pm cZ)=aE(X)\pm bE(Y)\pm cE(Z);\ \ V(aX\pm bY\pm cZ)\overset{\text{ind}}{=}a^2V(X)+b^2V(Y)+c^2V(Z);$

$E(aXY)\overset{\text{ind.}}{=}a\,E(X).E(Y);\ V(aX\pm bY)=a^2V(X)+b^2V(Y)\pm 2a.b.\rho_{XY}.\sigma_X.\sigma_Y$

$x=g^{-1}(y)=g^{-1}\Rightarrow f_Y(y)=f_X(g^{-1})\left|\dfrac{dg^{-1}}{dy}\right|\quad\text{or}\quad F_X(x)=F_Y(g^{-1})\Rightarrow f_Y(y)=\dfrac{d\,F_Y(g^{-1})}{d\,y}$

$$f(x,y)\cong f(\bar{x},\bar{y})+(x-\bar{x})\ \frac{\partial\ f(x,y)}{\partial x}\ \Big|_{\bar{x},\bar{y}}+(y-\bar{y})\ \frac{\partial\ f(x,y)}{\partial y}\ \Big|_{\bar{x},\bar{y}}+\frac{1}{2}(x-\bar{x})^2\ \frac{\partial^2 f(x,y)}{\partial x^2}\ \Big|_{\bar{x},\bar{y}}$$
$$+\frac{1}{2}(y-\bar{y})^2\ \frac{\partial^2 f(x,y)}{\partial y^2}\ \Big|_{\bar{x},\bar{y}}+(x-\bar{x})(y-\bar{y})\frac{\partial^2 f(x,y)}{\partial x\partial y}\ \Big|_{\bar{x},\bar{y}}$$

$$E(Y)\cong g(\mu_{X_1},\mu_{X_2},\mu_{X_3},.......\mu_{Xn})+\frac{1}{2}\sum_{i=1}^{n}\left(\frac{\partial^2 g}{\partial X_i^2}\right)Var(X_i);\ \ V(g(x))\cong V(x)\left|\frac{dg(x)}{dx}\right|^2_{\mu_X}\ \text{or}\ V(Y)\cong\sum_{i=1}^{n}\ c_i{}^2V(X_i)$$

$P_X(x)=\binom{n}{x}\theta^x(1-\theta)^{n-x},\ E(x)=n\theta,\ V(x)=n\theta(1\text{-}\theta);\ \ P_X(x)=\dfrac{e^{-\lambda}\lambda^x}{x\,!},\ E(x)=\lambda,\ V(x)=\lambda;$

$P(x=k)=\theta\,(1\text{-}\theta)^{k-1},E(x)=\dfrac{1}{\theta};\ \ f_X(x)=\theta\,e^{-\theta x},\ \ E(x)=\dfrac{1}{\theta},\ \ V(x)=\dfrac{1}{\theta^2};\ N(\mu,\sigma)\Rightarrow Z=\dfrac{x\text{-}\mu}{\sigma};\quad f_X(x)=\dfrac{1}{\sqrt{2\pi}\,\sigma}e^{-\frac{1}{2}(\frac{x-\mu}{\sigma})^2}$

$N(\lambda,\xi),\ Z=\dfrac{\ln x-\lambda}{\xi},\lambda=\ln\mu-\dfrac{1}{2}\xi^2,\xi^2=\ln(1+\delta^2)\cong\delta^2,\ x_{med}=e^{\lambda};f_X(x)=\dfrac{1}{\sqrt{2\pi}\,\xi}e^{-\frac{1}{2}(\frac{\ln x-\lambda}{\xi})^2}$

$L(x_1,x_2,...,x_n;\theta_1,..\theta_k)=f(x_1;\theta_1,..\theta_k)f(x_2;\theta_1,..\theta_k)..f(x_n;\theta_1,..\theta_k);$

$\int ax\,dx=a\dfrac{x^2}{2};\int ax^n dx=a\dfrac{x^{n+1}}{n+1};\ \int_{c_1}^{c_2}ax^n dx=\dfrac{a}{n+1}(c_2^{n+1}-c_1^{n+1});\int\dfrac{dx}{x}=Ln|x|\ ;\ \int\dfrac{dx}{x^n}=-\dfrac{1}{(n-1)x^{n-1}};$

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i \quad \left(\text{or } \frac{1}{n}\sum_{j=1}^{k} f_j\, x_{j,mid}\right); \quad s^2_x = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2 \quad \left(\text{or } \frac{1}{n}\sum_{i=1}^{n} x_i^{\,2} - \bar{x}^2\right); \text{ also}$$

$$s^2_x = \frac{1}{n-1}\sum_{j=1}^{k} f_j (x_{j,mid.} - \bar{x})^2 \; ; \text{ or } \frac{1}{n-1}\sum_{j=1}^{k} f_j x^2_{j,mid.} - \frac{n}{n-1}\, \bar{x}^{2} \; . \; \text{c.o.v} = v = \frac{s}{\bar{x}}; \quad \text{s.e.}(\bar{x})\frac{s}{\sqrt{n}}$$

$iqr = Q_3 - Q_1$; $Q_d = x_{(i)} + [(n+1)d - i](x_{(i+1)} - x_{(i)})$; $i \le (n+1)d$

$$k = \sqrt{n} \text{ or } k = 1 + 3.3 \log_{10} n \text{ or } k = \frac{r\, n^{1/3}}{2(iqr)} \; ; \; z_{score} = \frac{x - \bar{x}}{s} \quad g_1 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^3}{n\, s^3}; \quad g_2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^4}{n\, s^4}.$$