Table 1: Formulae Sheet

$\bar{x} = \sum_{i=1}^{n} \frac{x_i}{n} = \frac{x_1+x_2+\ldots+x_n}{n}$
$\sigma^2 = \sum_{i=1}^{n} \frac{(x_i-\bar{x})^2}{n-1}, \ \sigma = \sqrt{\sigma^2}$
${}_nP_r = n(n-1)\ldots(n-r+1) = \frac{n!}{(n-r)!}$
$\left(\begin{array}{c} n \\ r \end{array}\right) = \frac{n!}{r!(n-r)!}$
$\left(\begin{array}{c} n \\ n_1, n2_, \ldots, n_r \end{array}\right) = \frac{n!}{n_1!n_2!\ldots n_r!}, (where\ n_1+n_2+\ldots+n_r = n)$
$C(n,r) = \left(\begin{array}{c} n \\ r \end{array}\right) = \frac{n!}{r!(n-r)!}$
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$
$P(B \mid A) = \frac{P(A \cap B)}{P(A)}$
$P(B \mid A) = P(B)\ or\ P(A \mid B) = P(A).$
$P(A_1 \cap A_2 \cap \ldots \cap A_k) = P(A_1)P(A_2 \mid A_1)P(A_3 \mid A_1 \cap A_2)$
$P(A) = \sum_{i=1}^{k} P(B_i \cap A) = \sum_{i=1}^{k} P(B_i)P(A \mid B_i)$
$P(B_r \mid A) = \frac{P(B_r \cap A)}{\sum_{i=1}^{k} P(B_i \cap A} = \frac{P(B_r)P(A \mid B_r)}{\sum_{i=1}^{k} P(B_i)P(A \mid B_i)}$
$P(B_r \mid A) = P(B_r \cap A)/P(A)$
$F(x) = P(X \leq x) = \sum_{t \leq x} f(t),\ for\ -\infty < x < \infty$ $F(x) = P(X \leq x) = \int_{-\infty}^{x} f(t)dt\ for\ -\infty < x < \infty$
$g(x) = \sum_{y} f(x,y)\ and\ h(y) = \sum_{x} f(x,y)$ $g(x) = \int_{-\infty}^{\infty} f(x,y)dy\ and\ h(y) = \int_{-\infty}^{\infty} f(x,y)dx$
$f(y \mid x) = \frac{f(x,y)}{g(x)}, g(x) > 0$ $f(x \mid y) = \frac{f(x,y)}{h(y)}, h(y) > 0$
$P(a < X < b \mid Y = y) = \sum_{x} f(x \mid y),\ for\ the\ discrete\ case$ $P(a < X < b \mid Y = y) = \int_{a}^{b} f(x \mid y),\ for\ the\ continuous\ case$
$\left\{\begin{array}{l} \mu = E(X) = \sum_{x} xf(x)\ if\ X\ is\ discrete \\ \mu = E(X) = \int_{-\infty}^{\infty} xf(x)dx\ if\ X\ is\ continuous \end{array}\right.$
$\left\{\begin{array}{l} \mu_{g(X)} = E[g(X)] = \sum_{x} g(x)f(x)\ if\ X\ is\ discrete \\ \mu_{g(X)} = E[g(X)] = \int_{-\infty}^{\infty} g(x)f(x)dx\ if\ X\ is\ continuous \end{array}\right.$
$\left\{\begin{array}{l} \sigma^2 = E(X-\mu)^2 = \sum_{x}(x-\mu)^2 f(x),\ if\ X\ is\ discrete \\ \sigma^2 = E(X-\mu)^2 = \int_{-\infty}^{\infty}(x-\mu)^2 f(x)dx,\ if\ X\ is\ continuous \end{array}\right.$
$\left\{\begin{array}{l} \sigma_{g(X)}^2 = E\left\{[g(X)-\mu_{g(X)}]^2\right\} = \sum_{x}[g(X)-\mu_{g(X)}]^2, \\ if\ X\ is\ discrete \\ \sigma_{g(X)}^2 = E\left\{[g(X)-\mu_{g(X)}]^2\right\} = \int_{-\infty}^{\infty}[g(X)-\mu_{g(X)}]^2 f(x)dx, \\ if\ X\ is\ continuous \end{array}\right.$
$\sigma_{XY} = E(XY) - \mu_X\mu_Y$ $\rho_{XY} = \frac{\sigma_{XY}}{\sigma_X\sigma_Y},\ -1 \leq \rho_{XY} \leq 1$
$P(\mu - k\sigma < X < \mu + k\sigma) \geq 1 - \frac{1}{k^2}$

Table 2: Formulae Sheet Cont.

$b(x;n,p) = \binom{n}{x} p^x q^{n-x}, \quad x = 0,1,2,\ldots,n \qquad B(r;n,p) = \sum_{x=0}^{r} b(x;n,p)$ $\mu = np \text{ and } \sigma^2 = npq$
$h(x;N,n,k) = \dfrac{\binom{k}{x}\binom{N-k}{n-x}}{\binom{N}{n}} \qquad \mu = \frac{nk}{N} \text{ and } \sigma^2 = \frac{N-n}{n-1} * n * \frac{k}{N} * \left(1 - \frac{k}{N}\right)$
$f(x_1,x_2,\ldots,x_k;a_1,a_2,\ldots,a_k,N,n) = \dfrac{\binom{a_1}{x_1}\binom{a_2}{x_2}\cdots\binom{a_k}{x_x}}{\binom{N}{n}}$
$b^*(x;k,p) = \binom{x-1}{k-1} p^k q^{x-k}, \ x = k, k+1, k+2, \ldots$ $g(x;p) = b^*(x;1,p) = pq^{x-1}, x = 1,2,3,\ldots \qquad \mu = \frac{1}{p}, \quad \sigma^2 = \frac{1-p}{p^2}$
$p(x;\lambda t) = \frac{e^{-\lambda t}(\lambda t)^x}{x!}$
$n(x;\mu,\sigma) = \frac{1}{\sqrt{2\pi\sigma}} e^{-\frac{1}{2\sigma^2}(x-\mu)^2}, \ -\infty < x < \infty \qquad Z = \frac{X-\mu}{\sigma} \qquad Z = \frac{X-np}{\sqrt{npq}}$
$f(x) = \begin{cases} \frac{1}{\beta^\alpha \Gamma(\alpha)} x^{\alpha-1} e^{-x/\beta}, & x > 0 \\ 0, & elsewhere \end{cases} \qquad \Gamma(n+1) = n\Gamma(n) = n!$ $\mu = \alpha\beta \text{ and } \sigma^2 = \alpha\beta^2$
$f(x) = \begin{cases} \frac{1}{\beta} e^{-x/\beta}, & x > 0 \\ 0, & elsewhere \end{cases} \qquad \mu = \beta \text{ and } \sigma^2 = \beta^2$
$f(x;\nu) = \begin{cases} \frac{1}{2^{\nu/2}\Gamma(\nu/2)} x^{\nu/2-1} e^{-x/2}, & x > 0 \\ 0, & elsewhere \end{cases} \qquad \mu = \nu \text{ and } \sigma^2 = 2\nu$
$f(x) = \begin{cases} \frac{1}{\sqrt{2\pi}\sigma x} e^{-\frac{1}{2}[(ln(x)-\mu)/\sigma]^2}, & x \geq 0 \\ 0, & x < 0 \end{cases} \qquad \mu = e^{\mu+\sigma^2/2} \text{ and } \sigma^2 = e^{2\mu+\sigma^2} * (e^{\sigma^2} - 1)$
$E(\bar{X}) = \mu_{\bar{X}} = \frac{\mu+\mu+\ldots+\mu}{n} = \mu \qquad \sigma^2_{\bar{X}} = \frac{\sigma^2+\sigma^2+\ldots+\sigma^2}{n^2} = \frac{\sigma^2}{n} \ (or \ \frac{\sigma^2}{n}\left(\frac{N-n}{N-1}\right)) \qquad Z = \frac{\bar{X}-\mu}{\sigma/\sqrt{n}}$
$\mu_{\bar{X}_1-\bar{X}_2} = \mu_1 - \mu_2 \qquad \sigma^2_{\bar{X}_1-\bar{X}_2} = \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2} \qquad Z = \frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1}+\frac{\sigma_2^2}{n_2}}}$
$h(t) = \frac{\Gamma[(\nu+1)/2]}{\Gamma(\nu/2)\sqrt{\pi\nu}}(1+\frac{t^2}{\nu})^{-(\nu+1)/2}, -\infty < t < \infty \qquad T = \frac{Z}{\sqrt{V/\nu}}$
$h(f) = \begin{cases} \frac{\Gamma[(\nu_1+\nu_2)/2](\nu_1/\nu_2)^{\nu_1/2}}{\Gamma(\nu_1/2)\Gamma(\nu_2/2)} \frac{f^{\nu_1/2-1}}{(1+\nu_1 f/\nu_2)^{(\nu_1+\nu_2)+1}}, & f > 0 \\ 0, & f \leq 0 \end{cases} \qquad F = \frac{U/\nu_1}{V/\nu_2} = \frac{S_1^2/\sigma_1^2}{S_2^2/\sigma_2^2} = \frac{\sigma_2^2 S_1^2}{\sigma_1^2 S_2^2}$
$\int u dv = uv - \int v du$