MS204 CRIB SHEET

$$\mu = \frac{\sum_{i=1}^{N} X_i}{N} \simeq \frac{\sum_{j=1}^{g} m_j f_j}{N} \qquad \bar{X} = \frac{\sum_{i=1}^{n} X_i}{n} \simeq \frac{\sum_{j=1}^{g} m_j f_j}{n} \qquad \bar{X}_G = (X_1 * X_2 * \ldots * X_n)^{\frac{1}{n}}$$

$$\text{Range} = X_{largest} - X_{smallest} \qquad \text{Midrange} = \frac{X_{smallest} + X_{largest}}{2}$$

Q_1 = The value corresponding to the $\frac{N+1}{4}^{\underline{th}}$ ordered observation

Q_2 = Median, the value corresponding to the $\frac{N+1}{2}^{\underline{th}}$ ordered observation

Q_3 = The value corresponding to the $\frac{3(N+1)}{4}^{\underline{th}}$ ordered observation

$$\sigma^2 = \frac{\sum_{i=1}^{N} (X_i - \mu)^2}{N} \simeq \frac{\sum_{j=1}^{g} (m_j - \mu)^2 f_j}{N} \qquad S^2 = \frac{\sum_{i=1}^{n} (X_i - \bar{X})^2}{n - 1} \simeq \frac{\sum_{j=1}^{g} (m_j - \bar{X})^2 f_j}{n - 1}$$

$$\text{Standard Deviation} = \sqrt{\text{Variance}} \qquad \sigma = \sqrt{\sigma^2} \qquad S = \sqrt{S^2}$$

$$\text{Midhinge} = \frac{Q_1 + Q_3}{2} \qquad \text{Interquartile Range} = Q_3 - Q_1 \qquad \left(1 - \frac{1}{k^2}\right) * 100\% \qquad z = \frac{X - \bar{X}}{S}$$

$$CV = \left(\frac{S}{\bar{X}}\right) 100\% \qquad CV_{pop} = \left(\frac{\sigma}{\mu}\right) 100\% \qquad cov(X,Y) = \frac{\sum_{i=1}^{n} (X_i - \bar{X})(Y_i - \bar{Y})}{n - 1} \qquad r = \frac{cov(X,Y)}{S_X S_Y}$$

$$\text{Probability of Occurrence} = \frac{X}{T} \qquad P(A) = P(A \text{ and } B_1) + P(A \text{ and } B_2) + \ldots + P(A \text{ and } B_k)$$

$$P(A \text{ U } B) = P(A \text{ or } B) = P(A) + P(B) - P(A \cap B) \qquad P(A \text{ U } B) = P(A \text{ or } B) = P(A) + P(B)$$

$$P(A \cap B) = P(A \text{ and } B) = P(A|B)P(B) \qquad P(A \cap B) = P(A \text{ and } B) = P(A)P(B)$$

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)} \qquad P(B_i|A) = \frac{P(A|B_i)P(B_i)}{P(A|B_1)P(B_1) + P(A|B_2)P(B_2) + P(A|B_3)P(B_3) + \ldots + P(A|B_k)P(B_k)}$$

$$k^n \qquad (k_1)(k_2) \ldots (k_n) \qquad n! = n(n-1)(n-2) \ldots (1) \qquad {}_nP_X = \frac{n!}{(n-X)!} \qquad {}_nC_X = \binom{n}{X} = \frac{n!}{X!(n-X)!}$$

$$\mu = E(X) = \sum_{i=1}^{N} X_i P(X_i) \qquad \sigma^2 = \sum_{i=1}^{N} (X_i - \mu_x)^2 P(X_i) \qquad \sigma_{xy} = \sum_{i=1}^{N} [X_i - E(X)][Y_i - E(Y)]P(X_i Y_i)$$

$$E(X+Y) = E(X) + E(Y) \qquad Var(X+Y) = \sigma^2_{X+Y} = \sigma^2_X + \sigma^2_Y + 2\,\sigma_{XY}$$

SPECIAL PROBABILITY DISTRIBUTIONS

NAME	TYPE	FUNCTION	MEAN	VARIANCE	TABLE
BINOMIAL	DISCRETE	$P(X = x\|n,\pi) = \frac{n!}{X!(n-X)!}\pi^x(1-\pi)^{n-x}$	$n\pi$	$n\pi(1-\pi)$	YES
POISSON	DISCRETE	$P(X\|\lambda) = \frac{e^{-\lambda}\lambda^X}{X!}$	λ	λ	YES
HYPERGEOMETRIC	DISCRETE	$P(X\|A,N,n) = \frac{\binom{A}{X}\binom{N-A}{n-X}}{\binom{N}{n}}$	$\frac{nA}{N}$	$\frac{nA(N-A)}{N^2} * \frac{N-n}{(N-1)}$	NO
NORMAL	CONTINUOUS	$f(X\|\mu,\sigma) = \frac{1}{\sqrt{2\pi}\sigma}e^{-(\frac{1}{2})[\frac{(X-\mu)}{\sigma}]^2}$	μ	σ^2	YES
UNIFORM	CONTINUOUS	$f(X\|a,b) = \frac{1}{b-a}\ if\ a \le X \le b$	$\frac{a+b}{2}$	$\frac{(b-a)^2}{12}$	NO
EXPONENTIAL	CONTINUOUS	$P(\text{Arrival Time} < X) = 1 - e^{-\lambda X}$	λ		NO

$$Z = \frac{X-\mu}{\sigma} \qquad X = \mu + Z_{(\alpha/2)}\sigma \qquad \text{If } np \ge 5 \text{ and } n(1-p) \ge 5 \text{ then } \quad z = \frac{X_a - np}{\sqrt{np(1-p)}}$$

Where X_a= Number of successes with adjustment for continuity.

FOR SAMPLING DISTRIBUTIONS

$$\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}} \qquad Z = \frac{\bar{X}-\mu}{\sigma_{\bar{X}}} = \frac{\bar{X}-\mu}{\frac{\sigma}{\sqrt{n}}} \qquad t = \frac{\bar{X}-\mu}{\frac{s}{\sqrt{n}}} \qquad \bar{X} = \mu_x + Z_{(\alpha/2)}\sigma_{\bar{X}}$$

$$\text{If } n\pi \ge 5 \text{ and } n(1-\pi) \ge 5 \text{ then } \sigma_p = \sqrt{\frac{\pi(1-\pi)}{n}} \qquad Z \simeq \frac{p-\pi}{\sqrt{\frac{\pi(1-\pi)}{n}}}$$

$$\text{and } \pi = p \pm Z_{(\alpha/2)}\sqrt{\frac{p(1-p)}{n}} \qquad \text{Where } Z_{(\alpha/2)} = \text{The backward Z for } (\tfrac{\alpha}{2})$$

POP VAR	POP DIST	SAMPLE SIZE	(1-α)% CI	TEST STATISTIC
KNOWN	NORMAL	ANYTHING	$\mu = \bar{X} \pm Z_{(\alpha/2)}\frac{\sigma}{\sqrt{n}}$	$Z_{cal} = \frac{\bar{X}-\mu}{\sigma/\sqrt{n}}$
KNOWN	ANYTHING	$n \ge 30$	$\mu = \bar{X} \pm Z_{(\alpha/2)}\frac{\sigma}{\sqrt{n}}$	$Z_{cal} = \frac{\bar{X}-\mu}{\sigma/\sqrt{n}}$
UNKNOWN	NORMAL	ANYTHING	$\mu = \bar{X} \pm t_{(\alpha/2,\ df=n-1)}\frac{s}{\sqrt{n}}$	$t_{cal} = \frac{\bar{X}-\mu}{s/\sqrt{n}}$

$$n = \frac{Z^2\sigma^2}{e^2} \qquad n = \frac{Z^2\pi(1-\pi)}{e^2} \qquad \chi^2 = \frac{(n-1)S^2}{\sigma^2} \sim \chi^2_{(n-1)}$$