

Formulas

Chapter 3

$$\bar{x} = \frac{\sum x}{n} \quad \text{Mean}$$

$$\bar{x} = \frac{\sum(f \cdot x_m)}{\sum f} \quad \text{Mean (frequency distribution)}$$

$$s = \sqrt{\frac{n(\sum x^2) - (\sum x)^2}{n(n-1)}} \quad \text{Standard deviation (shortcut)}$$

$$s = \sqrt{\frac{n[\sum(f \cdot x_m^2)] - [\sum f \cdot x_m]^2}{n(n-1)}} \quad \text{Standard deviation}$$

$$s^2 \quad \text{Variance}$$

$$IQR = Q_3 - Q_1 \quad \text{Interquartile Range}$$

$$Q_1 - 1.5(IQR) \text{ and } Q_3 + 1.5(IQR) \quad \text{Outliers}$$

Chapter 4

$$P(E) = \frac{\text{\# of ways E can occur}}{\text{sample space (n)}} \quad \text{Probability}$$

$$P(A \text{ or } B) = P(A) + P(B) \quad \text{if A, B are mutually exclusive}$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) \quad \text{if A, B are not mutually exclusive}$$

$$P(A \text{ and } B) = P(A) \cdot P(B) \quad \text{if A, B are independent}$$

$$P(A \text{ and } B) = P(A) \cdot P(B|A) \quad \text{if A, B are dependent}$$

$$P(B|A) = \frac{P(A \text{ and } B)}{P(A)} \quad \text{Conditional probability}$$

$$P(A) = 1 - P(\bar{A}) \quad \text{Rule of complements}$$

$${}_nP_r = \frac{n!}{(n-r)!} \quad \text{Permutation (no elements alike)}$$

$$\frac{n!}{n_1!n_2!\dots n_k!} \quad \text{Permutation (elements alike)}$$

$${}_nC_r = \frac{n!}{(n-r)!r!} \quad \text{Combinations}$$

Chapter 5

$$\mu = \sum [x \cdot P(x)] \quad \text{Mean (Probability Distribution)}$$

$$\sigma = \sqrt{\sum [x^2 \cdot P(x)] - \mu^2} \quad \text{Standard Deviation (Probability Distribution)}$$

$$E(X) = \mu \quad \text{Expected Value}$$

$$P(X) = {}_nC_x \cdot p^x q^{n-x} \quad \text{Binomial Probability}$$

$$\mu = np \quad \text{Mean (binomial)}$$

$$\sigma^2 = npq \quad \text{Variance (binomial)}$$

$$\sigma = \sqrt{npq} \quad \text{Standard deviation (binomial)}$$

$$P(X) = \frac{e^{-\mu} \mu^x}{x!} \quad \text{Poisson}$$

Chapter 6

$$Z = \frac{x - \bar{x}}{s} \quad \text{or} \quad Z = \frac{x - \mu}{\sigma} \quad \text{z-score}$$

$$Z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} \quad \text{Central Limit Theorem}$$

Chapter 7

Confidence Intervals

$$\hat{p} - E < p < \hat{p} + E, \quad \text{Proportion}$$

$$E = Z_{\alpha/2} \sqrt{\frac{\hat{p}\hat{q}}{n}}$$

$$\bar{x} - E < \mu < \bar{x} + E, \quad \text{Mean}$$

$$E = t_{\alpha/2} \frac{s}{\sqrt{n}} \quad (\sigma \text{ unknown})$$

$$\text{Or } E = Z_{\alpha/2} \frac{\sigma}{\sqrt{n}} \quad (\sigma \text{ known})$$

$$\frac{(n-1)s^2}{\chi_R^2} < \sigma^2 < \frac{(n-1)s^2}{\chi_L^2}, \text{ Variance}$$

Sample size

$$n = \frac{Z_{\alpha/2}^2 \cdot 0.25}{E^2} \quad (\text{unknown proportion})$$

$$n = \frac{Z_{\alpha/2}^2 \cdot \hat{p}\hat{q}}{E^2} \quad (\text{known proportion})$$

$$n = \left(\frac{Z_{\alpha/2} \sigma}{E} \right)^2$$

Chapter 8

Test Statistics (one population)

$$z = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}} \quad \text{Proportion}$$

$$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} \quad \text{Mean - } \sigma \text{ unknown}$$

$$z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}} \quad \text{Mean - } \sigma \text{ known}$$

Chapter 9**Confidence Intervals (two populations)**

$(\hat{p}_1 - \hat{p}_2) - E < p_1 - p_2 < (\hat{p}_1 - \hat{p}_2) + E$, Proportions

$$E = Z_{\alpha/2} \sqrt{\frac{\hat{p}_1 \hat{q}_1}{n_1} + \frac{\hat{p}_2 \hat{q}_2}{n_2}}$$

$(\bar{x}_1 - \bar{x}_2) - E < \mu_1 - \mu_2 < (\bar{x}_1 - \bar{x}_2) + E$, Mean

$$E = t_{\alpha/2} \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}, \text{ if } \sigma_1, \sigma_2, \text{ are unknown}$$

$df = n_1 - 1$ OR $df = n_2 - 1$ whichever is smaller

$$\text{OR } E = Z_{\alpha/2} \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}, \text{ if } \sigma_1, \sigma_2, \text{ are known}$$

$\bar{d} - E < \mu_d < \bar{d} + E$, matched pairs

$$E = t_{\alpha/2} \cdot \frac{s_d}{\sqrt{n}}, df = n - 1$$

Test Statistics (two populations)

$$z = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\frac{\hat{p}\hat{q}}{n_1} + \frac{\hat{p}\hat{q}}{n_2}}}, \text{ two proportions}$$

$$\hat{p} = \frac{x_1 + x_2}{n_1 + n_2}$$

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}, \text{ two means if } \sigma_1, \sigma_2, \text{ are unknown}$$

$df = n_1 - 1$ OR $df = n_2 - 1$ whichever is smaller

$$z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}, \text{ two means if } \sigma_1, \sigma_2, \text{ are known}$$

$$t = \frac{\bar{d} - \mu_d}{\frac{s_d}{\sqrt{n}}}, \text{ matched pairs}$$

$$F = \frac{s_1^2}{s_2^2}, s_1^2 \text{ is the larger of the two variances}$$

numerator $df = n_1 - 1$ and denominator $df = n_2 - 1$

Chapter 10**Linear Correlation test-statistic**

$$t = \frac{r}{\sqrt{\frac{1-r^2}{n-2}}} df = n - 2$$

Chapter 11**Goodness-of-fit**

$$\chi^2 = \sum \frac{(O-E)^2}{E} df = k - 1$$

Contingency Tables

$$E = \frac{(\text{row total})(\text{column total})}{\text{grand total}}$$

$$df = (r - 1)(c - 1)$$

Chapter 12**ANOVA**

$$F = \frac{\text{variance between samples}}{\text{variance within samples}}$$