KEY FORMULAS Lind, Marchal, and Wathen • *Basic Statistics for Business and Economics,* 8th edition

CHAPTER 3

- Population mean

$$\mu = \frac{\Sigma X}{N} \quad [3\text{–}1]$$

- Sample mean, raw data

$$\bar{X} = \frac{\Sigma X}{n} \quad [3\text{–}2]$$

- Weighted mean

$$\bar{X}_w = \frac{w_1X_1 + w_2X_2 + \cdots + w_nX_n}{w_1 + w_2 + \cdots + w_n} \quad [3\text{–}3]$$

- Range

$$\text{Range} = \text{Maximum value} - \text{Minimum value} \quad [3\text{–}4]$$

- Mean deviation

$$MD = \frac{\Sigma|X - \bar{X}|}{n} \quad [3\text{–}5]$$

- Population variance

$$\sigma^2 = \frac{\Sigma(X - \mu)^2}{N} \quad [3\text{–}6]$$

- Population standard deviation

$$\sigma = \sqrt{\frac{\Sigma(X - \mu)^2}{N}} \quad [3\text{–}7]$$

- Sample variance

$$s^2 = \frac{\Sigma(X - \bar{X})^2}{n - 1} \quad [3\text{–}8]$$

- Sample standard deviation

$$s = \sqrt{\frac{\Sigma(X - \bar{X})^2}{n - 1}} \quad [3\text{–}9]$$

CHAPTER 4

- Location of a percentile

$$L_p = (n + 1)\frac{P}{100} \quad [4\text{–}1]$$

- Pearson's coefficient of skewness

$$sk = \frac{3(\bar{X} - \text{Median})}{s} \quad [4\text{–}2]$$

- Software coefficient of skewness

$$sk = \frac{n}{(n - 1)(n - 2)}\left[\Sigma\left(\frac{X - \bar{X}}{s}\right)^3\right] \quad [4\text{–}3]$$

CHAPTER 5

- Special rule of addition

$$P(A \text{ or } B) = P(A) + P(B) \quad [5\text{–}2]$$

- Complement rule

$$P(A) = 1 - P(\sim A) \quad [5\text{–}3]$$

- General rule of addition

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B) \quad [5\text{–}4]$$

- Special rule of multiplication

$$P(A \text{ and } B) = P(A)P(B) \quad [5\text{–}5]$$

- General rule of multiplication

$$P(A \text{ and } B) = P(A)P(B|A) \quad [5\text{–}6]$$

- Multiplication formula

$$\text{Total outcomes} = (m)(n) \quad [5\text{–}7]$$

- Number of permutations

$${}_nP_r = \frac{n!}{(n - r)!} \quad [5\text{–}8]$$

- Number of combinations

$${}_nC_r = \frac{n!}{r!(n - r)!} \quad [5\text{–}9]$$

CHAPTER 6

- Mean of a probability distribution

$$\mu = \Sigma[xP(x)] \quad [6\text{–}1]$$

- Variance of a probability distribution

$$\sigma^2 = \Sigma[(x - \mu)^2P(x)] \quad [6\text{–}2]$$

- Binomial probability distribution

$$P(x) = {}_nC_x\,\pi^x(1 - \pi)^{n - x} \quad [6\text{–}3]$$

- Mean of a binomial distribution

$$\mu = n\pi \quad [6\text{–}4]$$

- Variance of a binomial distribution

$$\sigma^2 = n\pi(1 - \pi) \quad [6\text{–}5]$$

- Poisson probability distribution

$$P(x) = \frac{\mu^x e^{-\mu}}{x!} \quad [6\text{–}6]$$

- Mean of a Poisson distribution

$$\mu = n\pi \quad [6\text{–}7]$$

CHAPTER 7

- Mean of a uniform distribution

$$\mu = \frac{a + b}{2} \quad [7\text{–}1]$$

- Standard deviation of a uniform distribution

$$\sigma = \sqrt{\frac{(b - a)^2}{12}} \quad [7\text{–}2]$$

- Uniform probability distribution

$$P(x) = \frac{1}{b - a} \quad [7\text{–}3]$$

if $a \le x \le b$ and 0 elsewhere

- Normal probability distribution

$$P(x) = \frac{1}{\sigma\sqrt{2\pi}}e^{-\left[\frac{(x-\mu)^2}{2\sigma^2}\right]} \quad [7\text{–}4]$$

- Standard normal value

$$z = \frac{X - \mu}{\sigma} \quad [7\text{–}5]$$

CHAPTER 8

- Standard error of mean

$$\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}} \quad [8\text{–}1]$$

- z-value, μ and σ known

$$z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}} \quad [8\text{–}2]$$

CHAPTER 9

- Confidence interval for μ, with σ known

$$\bar{X} \pm z\frac{\sigma}{\sqrt{n}} \quad [9\text{–}1]$$

- Confidence interval for μ, σ unknown

$$\bar{X} \pm t\frac{s}{\sqrt{n}} \quad [9\text{–}2]$$

- Sample proportion

$$p = \frac{X}{n} \quad [9\text{–}3]$$

- Confidence interval for proportion

$$p \pm z\sqrt{\frac{p(1 - p)}{n}} \quad [9\text{–}4]$$

- Sample size for estimating mean

$$n = \left(\frac{z\sigma}{E}\right)^2 \quad [9\text{–}5]$$

- Sample size for a proportion

$$n = \pi(1 - \pi)\left(\frac{z}{E}\right)^2 \quad [9\text{–}6]$$

CHAPTER 10

- Testing a mean, σ known

$$z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}} \quad [10\text{–}1]$$

- Testing a mean, σ unknown

$$t = \frac{\bar{X} - \mu}{s/\sqrt{n}} \quad [10\text{–}2]$$

- Test of hypothesis, one proportion

$$z = \frac{p - \pi}{\sqrt{\frac{\pi(1 - \pi)}{n}}} \quad [10\text{–}3]$$

CHAPTER 11

- Variance of the distribution of difference in means

$$\sigma^2_{\bar{x}_1 - \bar{x}_2} = \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2} \quad [11\text{–}1]$$

- Two-sample test of means, known σ

$$z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} \quad [11\text{–}2]$$

- Two-sample test of proportions

$$z = \frac{p_1 - p_2}{\sqrt{\frac{p_c(1 - p_c)}{n_1} + \frac{p_c(1 - p_c)}{n_2}}} \quad [11\text{–}3]$$

- Pooled proportion

$$p_c = \frac{X_1 + X_2}{n_1 + n_2} \quad [11\text{–}4]$$

- Pooled variance

$$s_p^2 = \frac{(n_1 - 1)\, s_1^2 + (n_2 - 1)\, s_2^2}{n_1 + n_2 - 2} \quad [11\text{–}5]$$

- Two-sample test of means, unknown but equal σ

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{s_p^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \quad [11\text{–}6]$$

- Paired t test

$$t = \frac{\bar{d}}{s_d/\sqrt{n}} \quad [11\text{–}7]$$

CHAPTER 12

- Test for comparing two variances

$$F = \frac{s_1^2}{s_2^2} \quad [12\text{–}1]$$

- Sum of squares, total

$$\text{SS total} = \Sigma(X - \bar{X}_G)^2 \quad [12\text{–}2]$$

- Sum of squares, error

$$\text{SSE} = \Sigma(X - \bar{X}_c)^2 \quad [12\text{–}3]$$

- Sum of squares, treatments

$$\text{SST} = \text{SS total} - \text{SSE} \quad [12\text{–}4]$$

- Confidence interval for differences in treatment means

$$(\bar{X}_1 - \bar{X}_2) \pm t\sqrt{\text{MSE}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)} \quad [12\text{–}5]$$

CHAPTER 13

- Correlation coefficient

$$r = \frac{\Sigma(X - \bar{X})(Y - \bar{Y})}{(n - 1)\, s_x s_y} \quad [13\text{–}1]$$

- Test for significant correlation

$$t = \frac{r\sqrt{n - 2}}{\sqrt{1 - r^2}} \quad [13\text{–}2]$$

- Linear regression equation

$$\hat{Y} = a + bX \quad [13\text{–}3]$$

- Slope of the regression line

$$b = r\frac{s_y}{s_x} \quad [13\text{–}4]$$

- Intercept of the regression line

$$a = \bar{Y} - b\bar{X} \quad [13\text{–}5]$$

- Test for a zero slope

$$t = \frac{b - 0}{s_b} \quad [13\text{–}6]$$

- Standard error of estimate

$$s_{y \cdot x} = \sqrt{\frac{\Sigma(Y - \hat{Y})^2}{n - 2}} \quad [13\text{–}7]$$

- Coefficient of determination

$$r^2 = \frac{\text{SSR}}{\text{SS total}} = 1 - \frac{\text{SSE}}{\text{SS total}} \quad [13\text{–}8]$$

- Standard error of estimate

$$s_{y \cdot x} = \sqrt{\frac{\text{SSE}}{n - 2}} \quad [13\text{–}9]$$

- Confidence interval

$$\hat{Y} \pm t(s_{y \cdot x})\sqrt{\frac{1}{n} + \frac{(X - \bar{X})^2}{\Sigma(X - \bar{X})^2}} \quad [13\text{–}10]$$

- Prediction interval

$$\hat{Y} \pm t(s_{y \cdot x})\sqrt{1 + \frac{1}{n} + \frac{(X - \bar{X})^2}{\Sigma(X - \bar{X})^2}} \quad [13\text{–}11]$$

CHAPTER 14

- Multiple regression equation

$$\hat{Y} = a + b_1X_1 + b_2X_2 + \cdots + b_kX_k \quad [14\text{–}1]$$

- Multiple standard error of estimate

$$s_{Y \cdot 123\ldots k} = \sqrt{\frac{\Sigma(Y - \hat{Y})^2}{n - (k + 1)}} \quad [14\text{–}2]$$

- Coefficient of multiple determination

$$R^2 = \frac{\text{SSR}}{\text{SS total}} \quad [14\text{–}3]$$

- Adjusted coefficient of determination

$$R^2_{adj} = 1 - \frac{\frac{\text{SSE}}{n - (k + 1)}}{\frac{\text{SS total}}{n - 1}} \quad [14\text{–}4]$$

- Global test of hypothesis

$$F = \frac{\text{SSR}/k}{\text{SSE}/[n - (k + 1)]} \quad [14\text{–}5]$$

- Testing for a particular regression coefficient

$$t = \frac{b_i - 0}{s_{b_i}} \quad [14\text{–}6]$$

- Variance inflation factor

$$VIF = \frac{1}{1 - R_j^2} \quad [14\text{–}7]$$

CHAPTER 15

- Chi-square test statistic

$$\chi^2 = \sum\left[\frac{(f_o - f_e)^2}{f_e}\right] \quad [15\text{–}1]$$

- Expected frequency

$$f_e = \frac{(\text{Row total})(\text{Column total})}{\text{Grand total}} \quad [15\text{–}2]$$