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CHAPTER 3

- Population mean

$$\mu = \frac{\Sigma x}{N} \qquad [3\text{–}1]$$

- Sample mean, raw data

$$\bar{x} = \frac{\Sigma x}{n} \qquad [3\text{–}2]$$

- Weighted mean

$$\bar{x}_w = \frac{w_1x_1 + w_2x_2 + \cdots + w_nx_n}{w_1 + w_2 + \cdots + w_n} \qquad [3\text{–}3]$$

- Geometric mean

$$GM = \sqrt[n]{(x_1)(x_2)(x_3)\cdots(x_n)} \qquad [3\text{–}4]$$

- Geometric mean rate of increase

$$GM = \sqrt[n]{\frac{\text{Value at end of period}}{\text{Value at start of period}}} - 1.0 \qquad [3\text{–}5]$$

- Range

$$\text{Range} = \text{Maximum value} - \text{Minimum value} \qquad [3\text{–}6]$$

- Population variance

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

- Population standard deviation

$$\sigma = \sqrt{\frac{\Sigma(x - \mu)^2}{N}} \qquad [3\text{–}8]$$

- Sample variance

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

- Sample standard deviation

$$s = \sqrt{\frac{\Sigma(x - \bar{x})^2}{n - 1}} \qquad [3\text{–}10]$$

- Sample mean, grouped data

$$\bar{x} = \frac{\Sigma fM}{n} \qquad [3\text{–}11]$$

- Sample standard deviation, grouped data

$$s = \sqrt{\frac{\Sigma f(M - \bar{x})^2}{n - 1}} \qquad [3\text{–}12]$$

CHAPTER 4

- Location of a percentile

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

- Pearson's coefficient of skewness

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

- Software coefficient of skewness

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

CHAPTER 5

- Special rule of addition

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

- Complement rule

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

- General rule of addition

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

- Special rule of multiplication

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

- General rule of multiplication

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

- Bayes' Theorem

$$P(A_1|B) = \frac{P(A_1)P(B|A_1)}{P(A_1)P(B|A_1) + P(A_2)P(B|A_2)} \qquad [5\text{–}7]$$

- Multiplication formula

$$\text{Total arrangements} = (m)(n) \qquad [5\text{–}8]$$

- Number of permutations

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

- Number of combinations

$$_nC_r = \frac{n!}{r!(n - r)!} \qquad [5\text{–}10]$$

CHAPTER 6

- Mean of a probability distribution

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

- Variance of a probability distribution

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

- Binomial probability distribution

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

- Mean of a binomial distribution

$$\mu = n\pi \qquad [6\text{–}4]$$

- Variance of a binomial distribution

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

- Hypergeometric probability distribution

$$P(x) = \frac{({}_SC_x)({}_{N-S}C_{n-x})}{{}_NC_n} \qquad [6\text{–}6]$$

- Poisson probability distribution

$$P(x) = \frac{\mu^xe^{-\mu}}{x!} \qquad [6\text{–}7]$$

- Mean of a Poisson distribution

$$\mu = n\pi \qquad [6\text{–}8]$$

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 $a \leq x \leq b$ 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

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

- Exponential distribution

$$P(x) = \lambda e^{-\lambda x} \quad [7\text{–}6]$$

- Finding a probability using the exponential distribution

$$P(\text{Arrival time} < x) = 1 - e^{-\lambda x} \quad [7\text{–}7]$$

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

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

- Type II error

$$z = \frac{\bar{x}_c-\mu_1}{\sigma/\sqrt{n}} \quad [10\text{–}3]$$

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

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

- Pooled variance

$$s_p^2 = \frac{(n_1-1)\,s_1^2 + (n_2-1)\,s_2^2}{n_1+n_2-2} \quad [11\text{–}3]$$

- Two-sample test of means, unknown but equal σ^2s

$$t = \frac{\bar{x}_1-\bar{x}_2}{\sqrt{s_p^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \quad [11\text{–}4]$$

- Two-sample tests of means, unknown and unequal σ^2s

$$t = \frac{\bar{x}_1-\bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \quad [11\text{–}5]$$

- Degrees of freedom for unequal variance test

$$df = \frac{[(s_1^2/n_1) + (s_2^2/n_2)]^2}{\frac{(s_1^2/n_1)^2}{n_1-1} + \frac{(s_2^2/n_2)^2}{n_2-1}} \quad [11\text{–}6]$$

- 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

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

- Sum of squares, treatments

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

- Confidence interval for differences in treatment means

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

- Sum of squares, blocks

$$SSB = k\Sigma(\bar{x}_b - \bar{x}_G)^2 \quad [12\text{–}6]$$

- Sum of squares error, two-way ANOVA

$$SSE = SS\ total - SST - SSB \quad [12\text{–}7]$$

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

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

- Standard error of estimate

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

- 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

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

- Coefficient of multiple determination

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

- Adjusted coefficient of determination

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

- Global test of hypothesis

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

- 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

- Test of hypothesis, one proportion

$$z = \frac{p - \pi}{\sqrt{\dfrac{\pi(1 - \pi)}{n}}} \quad [15\text{–}1]$$

- Two-sample test of proportions

$$z = \frac{p_1 - p_2}{\sqrt{\dfrac{p_c(1 - p_c)}{n_1} + \dfrac{p_c(1 - p_c)}{n_2}}} \quad [15\text{–}2]$$

- Pooled proportion

$$p_c = \frac{x_1 + x_2}{n_1 + n_2} \quad [15\text{–}3]$$

- Chi-square test statistic

$$\chi^2 = \sum\left[\frac{(f_o - f_e)^2}{f_e}\right] \quad [15\text{–}4]$$

- Expected frequency

$$f_e = \frac{(\text{Row total})(\text{Column total})}{\text{Grand total}} \quad [15\text{–}5]$$

CHAPTER 16

- Sign test, $n > 10$

$$z = \frac{(x \pm .50) - \mu}{\sigma} \quad [16\text{–}1]$$

- Wilcoxon rank-sum test

$$z = \frac{W - \dfrac{n_1(n_1 + n_2 + 1)}{2}}{\sqrt{\dfrac{n_1 n_2(n_1 + n_2 + 1)}{12}}} \quad [16\text{–}4]$$

- Kruskal-Wallis test

$$H = \frac{12}{n(n+1)}\left[\frac{(\Sigma R_1)^2}{n_1} + \frac{(\Sigma R_2)^2}{n_2} + \cdots + \frac{(\Sigma R_k)^2}{n_k}\right] - 3(n+1) \quad [16\text{–}5]$$

- Spearman coefficient of rank correlation

$$r_s = 1 - \frac{6\Sigma d^2}{n(n^2 - 1)} \quad [16\text{–}6]$$

- Hypothesis test, rank correlation

$$t = r_s\sqrt{\frac{n-2}{1-r_s^2}} \quad [16\text{–}7]$$

CHAPTER 17

- Simple index

$$P = \frac{p_t}{p_0}(100) \quad [17\text{–}1]$$

- Simple average of price relatives

$$P = \frac{\Sigma P_i}{n} \quad [17\text{–}2]$$

- Simple aggregate index

$$P = \frac{\Sigma p_t}{\Sigma p_0}(100) \quad [17\text{–}3]$$

- Laspeyres' price index

$$P = \frac{\Sigma p_t q_0}{\Sigma p_0 q_0}(100) \quad [17\text{–}4]$$

- Paasche's price index

$$P = \frac{\Sigma p_t q_t}{\Sigma p_0 q_t}(100) \quad [17\text{–}5]$$

- Fisher's ideal index

$$\sqrt{(\text{Laspeyres' price index})(\text{Paasche's price index})} \quad [17\text{–}6]$$

- Value index

$$V = \frac{\Sigma p_t q_t}{\Sigma p_0 q_0}(100) \quad [17\text{–}7]$$

- Real income

$$\text{Real income} = \frac{\text{Money income}}{\text{CPI}}(100) \quad [17\text{–}8]$$

- Using an index as a deflator

$$\text{Deflated sales} = \frac{\text{Actual sales}}{\text{Index}}(100) \quad [17\text{–}9]$$

- Purchasing power

$$\text{Purchasing power} = \frac{\$1}{\text{CPI}}(100) \quad [17\text{–}10]$$

CHAPTER 18

- Linear trend

$$\hat{y} = a + bt \quad [18\text{–}1]$$

- Log trend equation

$$\log \hat{y} = \log a + \log b(t) \quad [18\text{–}2]$$

- Correction factor for adjusting quarterly means

$$\text{Correction factor} = \frac{4.00}{\text{Total of four means}} \quad [18\text{–}3]$$

- Durbin-Watson statistic

$$d = \frac{\sum_{t=2}^{n}(e_t - e_{t-1})^2}{\sum_{t=1}^{n} e_t^2} \quad [18\text{–}4]$$

CHAPTER 19

- Grand mean

$$\bar{\bar{x}} = \frac{\Sigma \bar{x}}{k} \quad [19\text{–}1]$$

- Control limits, mean

$$\text{UCL} = \bar{\bar{x}} + A_2\bar{R} \qquad \text{LCL} = \bar{\bar{x}} - A_2\bar{R} \quad [19\text{–}4]$$

- Control limits, range

$$\text{UCL} = D_4\bar{R} \qquad \text{LCL} = D_3\bar{R} \quad [19\text{–}5]$$

- Mean proportion defective

$$p = \frac{\text{Total number defective}}{\text{Total number of items sampled}} \quad [19\text{–}6]$$

- Control limits, proportion

$$\text{UCL and LCL} = p \pm 3\sqrt{\frac{p(1-p)}{n}} \quad [19\text{–}8]$$

- Control limits, *c*-bar chart

$$\text{UCL and LCL} = \bar{c} \pm 3\sqrt{\bar{c}} \quad [19\text{–}9]$$

CHAPTER 20 (ON THE WEBSITE: www.mhhe.com/lind16e)

- Expected monetary value

$$\text{EMV}(A_i) = \Sigma[P(S_j) \cdot V(A_i, S_j)] \quad [20\text{–}1]$$

- Expected opportunity loss

$$\text{EOL}(A_i) = \Sigma[P(S_j) \cdot R(A_i, S_j)] \quad [20\text{–}2]$$

- Expected value of perfect information

EVPI = Expected value under conditions of certainty
− Expected value of optimal decision under conditions of uncertainty [20–3]