Formulas and Tables

For Essentials of Statistics, Second Edition, by Mario F. Triola

Ch. 2: Descriptive Statistics

$\bar{x} = \frac{\Sigma x}{n}$ Mean

$\bar{x} = \frac{\Sigma f \cdot x}{\Sigma f}$ Mean (frequency table)

$s = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$ Standard deviation

$s = \sqrt{\frac{n(\Sigma x^2) - (\Sigma x)^2}{n(n-1)}}$ Standard deviation (short-cut)

$S = \sqrt{\frac{n[\Sigma(f \cdot x^2)] - [\Sigma(f \cdot x)]^2}{n(n-1)}}$ Standard deviation (frequency table)

Ch. 3: Probability

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

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

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

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

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

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

$\frac{n!}{n_1!n_2!...n_k!}$ Permutations (n_1 alike, …)

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

Ch. 4: Probability Distributions

$\mu = \Sigma x \cdot P(x)$ Mean (prob. Dist.)

$\sigma = \sqrt{[\Sigma x^2 \cdot P(x)] - \mu^2}$ Standard deviation (prob. Dist.)

$P(x) = \frac{n!}{(n-x)!x!} \cdot p^x \cdot q^{n-x}$ Binomial probability

$\mu = n \cdot p$ Mean (binomial)

$\sigma^2 = n \cdot p \cdot q$ Variance (binomial)

$\sigma = \sqrt{n \cdot p \cdot q}$ Standard deviation (binomial)

Ch. 5: Normal Distribution

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

$\mu_{\bar{x}} = \mu$ Central limit theorem

$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ Central limit theorem (Standard error)

Ch. 6: Confidence Intervals (one population)

$\hat{p} - E < p < \hat{p} + E$ Proportion

where $E = z_{\alpha/2}\sqrt{\frac{\hat{p}\,\hat{q}}{n}}$

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

where $E = z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$ (σ known)

or $E = t_{\alpha/2}\frac{s}{\sqrt{n}}$ (σ unknown)

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

Ch 6: Sample Size Determination

$n = \frac{[z_{\alpha/2}]^2 \cdot 0.25}{E^2}$ Proportion

$n = \frac{[z_{\alpha/2}]^2\,\hat{p}\,\hat{q}}{E^2}$ Proportion ($\hat{p}$ and $\hat{q}$ are known)

$n = \left[\frac{z_{\alpha/2}\sigma}{E}\right]^2$ Mean

Ch. 8: Confidence Intervals (two populations)

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

where $E = z_{\alpha/2}\sqrt{\frac{\hat{p}_1\,\hat{q}_1}{n_1} + \frac{\hat{p}_2\,\hat{q}_2}{n_1}}$

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

where $E = t_{\alpha/2}\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$ (df = small of $n_1 - 1, n_2 - 1$)

(σ_1 and σ_2 unknown and not assumed equal)

$E = t_{\alpha/2}\sqrt{\frac{s_P^2}{n_1} + \frac{s_P^2}{n_2}}$ (df = $n_1 + n_2 - 2$)

$s_p^2 = \frac{(n_1 - 1s_1^2 + (n_2-1)s_2^2}{(n_1-1)+(n_2-1)}$

(σ_1 and σ_2 unknown but assumed equal)

$E = z_{\alpha/2}\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$

(σ_1, σ_2 known)

$\bar{d} - E < \mu_d < \bar{d} + E$ (Matched Pairs)

where $E = t_{\alpha/2}\frac{s_d}{\sqrt{n}}$. (df $= n-1$)

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Ch. 7: Test Statistics (one population)

$z = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}}$ Proportion—one population

$z = \frac{\bar{x} - \mu}{\sigma / \sqrt{n}}$ Mean—one population (σ known)

$t = \frac{\bar{x} - \mu}{s / \sqrt{n}}$ Mean—one population (σ unknown)

$\chi^2 = \frac{(n-1)s^2}{\sigma^2}$ Standard deviation or variance—one population

Ch. 8: Test Statistics (two populations)

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

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$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$ df = smaller of $n_1 - 1$, $n_2 - 2$

Two means—independent; σ_1 and σ_2 unknown, and not assumed equal.

$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu - \mu_2)}{\sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}}}$ (df $= n_1 + n_2 - 2$)

where $s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$

Two means—independent; σ_1 and σ_2 unknown, but assumed equal

$z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$ Two means—independent; σ_1, σ_2 known.

$t = \frac{\bar{d} - \mu_d}{s_d / \sqrt{n}}$ Two means—matched pairs

(df $= n - 1$)

Ch. 9: Linear Correlation/Regression

Correlation $r = \frac{n\Sigma xy - (\sum x)(\Sigma y)}{\sqrt{n(\Sigma x^2) - (\Sigma x)^2}\sqrt{n(\sum y^2) - (\sum y)^2}}$

$b_1 = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{n(\Sigma x^2) - (\Sigma x)^2}$

$b_0 = \bar{y} - b_1\bar{x}$

$\hat{y} = b_0 + b_1 x$ Estimated eq. of regression line

$r^2 = \frac{\text{explained variation}}{\text{total variation}}$

$S_e = \sqrt{\frac{\Sigma(y - \hat{y})^2}{n-2}}$ or $\sqrt{\frac{\Sigma y^2 - b_0\Sigma y - b_1\Sigma xy}{n-2}}$

$\hat{y} - E < y < \hat{y} + E$

where $E = t_{\alpha/2} S_e \sqrt{1 + \frac{1}{n} + \frac{n(x_0 - \bar{x})^2}{n(\Sigma x^2) - (\Sigma x)^2}}$

$r_S = 1 - \frac{6\Sigma d^2}{n(n^2 - 1)}$ Rank correlation

$\left(\text{critical value for } n > 30: \frac{\pm z}{\sqrt{n-1}}\right)$

Ch. 10: Multinomial and Contingency Tables

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

$\chi^2 = \Sigma\frac{(O-E)^2}{E}$ Contingency table [$df = (r-1)(c-1)$]

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

Ch. 10: One-Way Analysis of a Variance

$F = \frac{ns_{\bar{x}}^2}{s_P^2}$ k samples each of size n (num. $df = k - 1$; den. $df = k(n-1)$)

$F = \frac{\text{MS(treatment)}}{MS(error)}$ $\leftarrow df = k - 1$ $\leftarrow df = N - k$

$\text{MS(treatment)} = \frac{\text{SS(treatment)}}{k-1}$

$\text{MS(error)} = \frac{\text{SS(error)}}{N-k}$ $\text{MS(total)} = \frac{\text{SS(total)}}{N-1}$

$\text{SS(treatment)} = n_1(\bar{x}_1 - \bar{\bar{x}})^2 + \ldots + n_k(\bar{x}_k - \bar{\bar{x}})^2$

$\text{SS(error)} = (n_1 - 1)s_1^2 + \ldots + (n_k - 1)s_k^2$

$\text{SS(total)} = \Sigma(x - \bar{\bar{x}})^2$

SS(total) = SS(treatment) + SS(error)