10.9: Formula Review

10.2 Comparing Two Independent Population Means

Standard error: $SE=\sqrt{\frac{(s_1)^2}{n_1}+\frac{(s_2)^2}{n_2}}$

Test statistic (t-score): $t_c=\frac{(\bar{x}_1-\bar{x}_2)-\delta_0}{\sqrt{\frac{(s_1)^2}{n_1}+\frac{(s_2)^2}{n_2}}}$

Degrees of freedom:
\[d f=\frac{\left(\frac{\left(s_1\right)^2}{n_1}+\frac{\left(s_2\right)^2}{n_2}\right)^2}{\left(\frac{1}{n_1-1}\right)\left(\frac{\left(s_1\right)^2{n_1}\right)^2+\left(\frac{1}{n_2-1}\right)\left(\frac{\left(s_2\right)^2}{n_2}\right)^2}\]

where:

s_1 and s_2 are the sample standard deviations, and n_1 and n_2 are the sample sizes.

$\bar{x}_1$ and $\bar{x}_2$ are the sample means.

10.3 Cohen's Standards for Small, Medium, and Large Effect Sizes

Cohen's d is the measure of effect size:

$$d=\frac{\bar{x}_1-\bar{x}_2}{s_{\text{pooled}}} \tag{10.9.1}$$

where $s_{\text{pooled}}=\sqrt{\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}}$

10.4 Test for Differences in Means: Assuming Equal Population Variances

$$t_c=\frac{(\bar{x}_1-\bar{x}_2)-\delta_0}{\sqrt{S_p^2\left(\frac{1}{n_1}+\frac{1}{n_2}\right)}} \tag{10.9.2}$$

where Sp is the pooled variance given by the formula:

$$Sp=\frac{(n_1-1)\,s_1^2-(n_2-1)\,s_2^2}{n_1+n_2-2} \tag{10.9.3}$$

10.5 Comparing Two Independent Population Proportions

Pooled Proportion: $p_C=\frac{x_A+x_B}{n_A+n_B}$

Test Statistic (z-score): $Z_c=\frac{(p'{}_A-p'_B B)}{\sqrt{p_c(1-p_c)\left(\frac{1}{n_A}+\frac{1}{n_B}\right)}}$

where

p'_A and p'_B are the sample proportions, p_A and p_B are the population proportions,
P_C is the pooled proportion, and n_A and n_B are the sample sizes.

10.6 Two Population Means with Known Standard Deviations

Test Statistic (z-score):

\[Z_c=\frac{\left(\bar{x}_1-\bar{x}_2\right)-\delta_0}{\sqrt{\frac{\left(\sigma_1\right)^2}{n_1}+\frac{\left(\sigma_2\right)^2}{n_2}}\]

where:

σ_1 and σ_2 are the known population standard deviations. n_1 and n_2 are the sample sizes. $\bar{x}_1$ and $\bar{x}_2$ are the sample means. μ_1 and μ_2 are the population means.

10.7 Matched or Paired Samples

Test Statistic (t-score): $t_c = \frac{\bar{x}_d - \mu_d}{\left(\frac{s_d}{\sqrt{n}}\right)}$

where:

$\bar{x}_d$ is the mean of the sample differences. μ_{d} is the mean of the population differences. s_d is the sample standard deviation of the differences. n is the sample size.
