SOC 4015/5050: Lecture 07 Equations

Christopher Prener, Ph.D.

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One-sample T-test

$$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} \tag{1}$$

Degrees of freedom (v) is defined as $v = n - 1$.

Independent T-test, Homogeneous Variance

Independent T-test

$$t = \frac{\bar{X}_a - \bar{X}_b}{\sqrt{\frac{s_p^2}{n_a} + \frac{s_p^2}{n_b}}} \tag{2a}$$

Degrees of freedom (v) is defined as $v = n_a + n_b - 2$.

Pooled Variance

$$s_p^2 = \frac{(n_a - 1)s_a^2 + (n_b - 1)s_b^2}{n_a + n_b - 2} \tag{2b}$$

Independent T-test, Heterogeneous Variance

Independent T-test

$$t = \frac{\bar{x}_a - \bar{x}_b}{\sqrt{\frac{s_a^2}{n_a} + \frac{s_b^2}{n_b}}} \tag{3a}$$

Welch's Corrected Degrees of Freedom (v)

$$v \approx \frac{\left(\frac{s_a^2}{n_a} + \frac{s_b^2}{n_b}\right)^2}{\frac{s_a^4}{\left(n_a^2\right)(n_a - 1)} + \frac{s_b^4}{\left(n_b^2\right)(n_b - 1)}} \tag{3b}$$

Dependent T-test

$$t = \frac{\bar{d}}{\sqrt{\frac{s_d^2}{n}}} \tag{4}$$

Cohen's D

Note that groups t and c are defined for controlled experiments where $t = treatment$ and $c = control$. This can be applied to the above equations by defining $t = a$ and $c = b$.

General Equation

$$d = \frac{\bar{x}_a - \bar{x}_b}{\sqrt{\frac{(n_a - 1)s_a^2 + (n_b - 1)s_b^2}{n_a + n_b - 2}}} \tag{5a}$$

Cohen's D after T-test, $n_a = n_b$

$$d = \frac{2t}{\sqrt{v}} \tag{5b}$$

Cohen's D after T-test, $n_a \neq n_b$

$$d = \frac{t(n_a + n_b)}{\sqrt{v}(\sqrt{n_a + n_b})} \tag{5c}$$