

t Test

$$H_0 : \mu_1 = \mu_2$$

$$H_A : \mu_1 \neq \mu_2 \text{ (nondirectional)}$$

$$H_A : \mu_1 < \mu_2 \text{ (directional)}$$

$$H_A : \mu_1 > \mu_2 \text{ (directional)}$$

Test statistic:

$$t_s = \frac{(\bar{y}_1 - \bar{y}_2) - 0}{SE_{(\bar{y}_1 - \bar{y}_2)}}$$

where

$$SE_{(\bar{y}_1 - \bar{y}_2)} = \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} = \sqrt{SE_1^2 + SE_2^2}$$

P-value = tail area under Student's t curve with

$$df = \frac{(SE_1^2 + SE_2^2)^2}{\frac{SE_1^4}{(n_1-1)} + \frac{SE_2^4}{(n_2-1)}}$$

where $SE_1 = \frac{s_1}{\sqrt{n_1}}$ and $SE_2 = \frac{s_2}{\sqrt{n_2}}$.

Nondirectional H_A : P-value = two-tailed area beyond t_s and $-t_s$

Directional H_A :

Step 1: Check directionality

Step 2: P-value = single-tail area beyond t_s

Decision : Reject H_0 if P-value $\leq \alpha$