

MATH 140
DR. MCLOUGHLIN'S CLASS
STATISTICAL FORMULAE FOR TEST 3

$$\bar{X} = \frac{\sum_{k=1}^n X_k}{n}$$

$$S_X^2 = \frac{\sum_{k=1}^n (X_k - \bar{X})^2}{n-1}$$

$$S_X = \sqrt{\frac{\sum_{k=1}^n (X_k - \bar{X})^2}{(n-1)}}$$

$$S_{\bar{X}} = \frac{S_X}{\sqrt{n}}$$

$$\sigma_{\bar{X}} = \frac{\sigma_X}{\sqrt{n}}$$

$$Z_i = \frac{X_i - \mu_X}{\sigma_X}$$

$$Z = \frac{\bar{X} - \mu_{\bar{X}}}{\sigma_{\bar{X}}}$$

$$T = \frac{X - \bar{X}}{S_X}$$

$$T_{n-1} = \frac{\bar{X} - \mu_{\bar{X}}}{S_{\bar{X}}}$$

Independent t-test Pooled Variance Formula

$$t_{\text{pool}} = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\left(\frac{\sum_{k=1}^n (X_k - \bar{X})^2 + \sum_{k=1}^n (Y_k - \bar{Y})^2}{n_1 + n_2 - 2} \right) \cdot \left(\frac{1}{n_1} + \frac{1}{n_2} \right)}} \quad \text{with df being } n_1 + n_2 - 2$$

Paired Sample t-test

$$\text{First compute } r_{xy} \quad r_{xy} = \frac{\sum_{k=1}^n (X_k - \bar{X})(Y_k - \bar{Y})}{\sqrt{\sum_{k=1}^n (X_k - \bar{X})^2 \sum_{k=1}^n (Y_k - \bar{Y})^2}} = \frac{\sum_{k=1}^n (X_k - \bar{X})(Y_k - \bar{Y})}{n\sqrt{(S_X)(S_Y)}} = \frac{\sum_{k=1}^n (z_{X_k})(z_{Y_k})}{n}$$

Since if the samples are related (two measures from the same subject or matched pairs), the correlated data formula is used.

$$t_{\text{paired}} = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\left(\frac{S_X^2}{n} \right) + \left(\frac{S_Y^2}{n} \right) - 2r_{XY} \cdot \left(\frac{S_X \cdot S_Y}{n} \right)}} \quad \text{with df number of pairs minus one.}$$