Formulas for the Final Exam

$$\bar{y} = \frac{\sum y}{n} \quad s_y = \sqrt{\frac{\sum (y - \bar{y})^2}{n-1}} \quad \bar{x} = \frac{\sum x}{n} \quad s_x = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}}$$

$$r = \frac{\sum z_x z_y}{n-1} \quad z_x = \frac{x - \bar{x}}{s_x} \quad z_y = \frac{y - \bar{y}}{s_y}$$

$$b = r\frac{s_y}{s_x} \quad a = \bar{y} - b\bar{x} \quad \hat{y} = a + bx \quad \textbf{residual} = y - \hat{y}$$

Sampling Distribution of $\hat{p}$:
Mean: p
Standard Deviation: $\mathbf{SD}(\hat{p}) = \sqrt{\frac{p(1-p)}{n}}$

Sampling Distribution of $\bar{y}$:
Mean: μ
Standard Error: $\mathbf{SE}(\bar{y}) = \frac{s}{\sqrt{n}}$

Single sample (Categorical Variable)
Confidence interval for p:

$$\hat{p} - z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \ \textbf{to} \ \hat{p} + z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

Test Statistic:

$$z = \frac{\hat{p} - p_o}{\sqrt{\frac{p_0(1-p_0)}{n}}}$$

Single sample (Numerical Variable)
Confidence interval for μ:

$$\bar{y} - t^* \frac{s}{\sqrt{n}} \ \textbf{to} \ \bar{y} + t^* \frac{s}{\sqrt{n}}$$

Test Statistic:

$$t = \frac{\bar{y} - \mu_o}{\frac{s}{\sqrt{n}}} \qquad \text{df} = n - 1$$

Two independent samples
Confidence interval for $\mu_1 - \mu_2$:

$$(\bar{y}_1 - \bar{y}_2) - t^* \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}} \ \textbf{to} \ (\bar{y}_1 - \bar{y}_2) - t^* \sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}$$

Test Statistic:

$$t = \frac{(\bar{y}_1 - \bar{y}_2) - 0}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

Paired samples
Confidence interval for μ_d:

$$\bar{d} - t^* \frac{s_d}{\sqrt{n_d}} \ \textbf{to} \ \bar{d} + t^* \frac{s_d}{\sqrt{n_d}}$$

Test Statistic:

$$t = \frac{\bar{d} - \mu_d}{\frac{s_d}{\sqrt{n_d}}} \qquad \text{df} = n_d - 1$$