STAT 509 2017 Summer Quiz 3 Formula Sheet

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Lecture Day: June 5

- Construct confidence interval: **point estimate** $\pm$ **margin of error**:
  - Population proportion p: $\hat{p} \pm z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$
  - One population mean μ (σ known): $\bar{x} \pm z_{\frac{\alpha}{2}} \frac{\sigma}{\sqrt{n}}$
  - One population mean μ (σ unknown): $\bar{x} \pm t_{\frac{\alpha}{2},\text{df}} \frac{s}{\sqrt{n}}$ where $\text{df} = n - 1$
  - $\mu_1 - \mu_2$ with known σ_1^2 and σ_2^2:

$$(\overline{y}_1 - \overline{y}_2) \pm z_{\alpha/2} \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

- 4-step procedure to construct hypothesis testing:
  1. State H_0 and H_a
  2. Calculate test statistic:
     - Population proportion: $z_0 = \dfrac{\hat{p} - p_0}{\sqrt{\dfrac{p_0(1-p_0)}{n}}}$
     - Population mean (σ known): $z_0 = \dfrac{\bar{x} - \mu_0}{\sigma/\sqrt{n}}$
     - population mean (σ unknown): $t_0 = \dfrac{\bar{x} - \mu_0}{s/\sqrt{n}}$
     - $\mu_1 - \mu_2$ with known σ_1^2 and σ_2^2:

$$z_0 = \frac{\overline{y}_1 - \overline{y}_2}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

  3. Calculate p-value

$$\begin{aligned} H_a : p > p_0 (\mu > \mu_0) : &\quad P(Z > z_0) \text{ or } P(t > t_0) \\ H_a : p < p_0 (\mu < \mu_0) : &\quad P(Z < z_0) \text{ or } P(t < t_0) \\ H_a : p \neq p_0 (\mu \neq \mu_0) : &\quad 2P(Z < -|z_0|) \text{ or } 2P(t < -|t_0|) \end{aligned}$$

  4. Make decision and state conclusion:
     - p-value $\leq \alpha \Longrightarrow$ Reject H_0
     - p-value $> \alpha \Longrightarrow$ Fail to reject H_0