Chapter 10
Comparisons Involving Means

use $(\bar{x}_1 - \bar{x}_2)$ to estimate $(\mu_1 - \mu_2)$

Comparative Analysis

- Many decisions are based on differences between two (or more) groups
- Example
  - is there a difference between the reading scores of 3rd graders who receive extra reading activities compared with those who don't?
  - use $(\bar{x}_1 - \bar{x}_2)$ to estimate $(\mu_1 - \mu_2)$
- Common to test that there is no difference between the two populations
  - i.e., a null amount of difference

σ_1 and σ_2 Known

- $(\mu_1-\mu_2)$ is estimated by $(\bar{x}_1 - \bar{x}_2)$
- Sampling Distribution of the Difference Between Means
  - SDODBM
  - describes the possible values for $(\bar{x}_1 - \bar{x}_2)$
  - follows either t or z distribution
- Use z to set critical values(s) when:
  - you have historical data to estimate σ_1 and σ_2 AND
  - either ($n_1 \geq 30$ and $n_2 \geq 30$, regardless of pop shapes)
  - or (pop approx Normally distr when either n<30)
- Use the same 6-step hypothesis testing process

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σ_1 and σ_2 Known

- Standard Error of the Difference Between Means
  - measures the ROSE when testing the difference between population means with difference between sample means
  - why does the formula have two terms?

$$\sigma_{\bar{x}_1-\bar{x}_2} = \sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}$$

- Test statistic is $(\bar{x}_1 - \bar{x}_2)$

$$z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$$

- Regents Insurance assignment
- When you reject H_0 in a 2-tailed test, you can always reject the corresponding 1-tailed test

σ_1 and σ_2 Unknown

- When σ_1 & σ_2 are unknown, we must estimate them with s_1 & s_2
- Use t-distribution to set critical value(s) when

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- σ_1 and σ_2 are unknown, AND
- $n_1+n_2 \geq 20$

$$df = \frac{\left(\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}\right)^2}{\frac{1}{n_1-1}\left(\frac{s_1^2}{n_1}\right)^2+\frac{1}{n_2-1}\left(\frac{s_2^2}{n_2}\right)^2}$$

- Estimated Std Error of Difference Between Means
  - measures the ROSE when testing the difference between population means with difference between sample means

$$s_{\bar{x}_1-\bar{x}_2} = \sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}$$

σ_1 and σ_2 Unknown

- Follow the same 6-step process
- Test statistic is $(\bar{x}_1-\bar{x}_2)$

$$t = \frac{(\bar{x}_1-\bar{x}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}}$$

- Reading Activities assignment