AP Statistics – Chapter 13 Notes: Comparing Two Population Parameters

13.1: Comparing Two Means

Two-Sample Problems

- The goal of inference is to compare the responses to two treatments or to compare the characteristics of two populations.
- We have a separate sample from each treatment or each population.

Conditions for Comparing Two Means

- SRS – We have two SRS's, from two distinct populations
- Normality – Both populations are normally distributed <u>or</u> $n_1 + n_2 \geq 30$
- Independence – Each sample must be selected independently of the other (no pairing or matching) and each distinct population size must be 10 times greater than their samples.

Two-Sample t Confidence Interval

To estimate the difference between two population means ($\mu_1 - \mu_2$) use the formula

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

Two-Sample t-Test

To test the hypothesis H$_0$: $\mu_1 = \mu_2$, compute the two-sample t statistic

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

13.2: Comparing Two Proportions

Conditions for Comparing Two Proportions

- SRS – We have two SRSs, from two distinct populations
- Normality – Counts of "successes" and "failures" are all at least 5.
- Independence – Each sample must be selected independently of the other (no pairing or matching) and each distinct population size must be 10 times greater than their samples.

Two-Proportion z Confidence Interval

To estimate the difference between two population proportions ($p_1 - p_2$) use the formula

$$(\hat{p}_1 - \hat{p}_2) \pm z^* \sqrt{\frac{\hat{p}_1(1-\hat{p}_1)}{n_1} + \frac{\hat{p}_2(1-\hat{p}_2)}{n_2}}$$

Two-Proportion z-Test

To test the hypothesis H$_0$: $p_1 = p_2$, compute the two-proportion z statistic

$$z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}_c(1-\hat{p}_c)\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

Where $\hat{p}_c = \dfrac{x_1 + x_2}{n_1 + n_2}$