Inference Formulas — Math 222

One Sample Inference for Means

$$\bar{x} \pm t^* \frac{s}{\sqrt{n}} \qquad t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

Two Sample Inference for Means

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

One Sample Inference for Proportions

$$\hat{p} \pm z^* \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \qquad z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$$

Two Sample Inference for Proportions

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

Chi-squared formulas

$$\chi^2 = \sum \frac{(\textit{observed count} - \textit{expected count})^2}{\textit{expected count}}$$

Expected counts for 2-way tables

$$E_{ij} = \frac{\textit{row total} \times \textit{column total}}{\textit{table total}}$$

Least squares regression line

$$\hat{y} = b_0 + b_1 x, \quad \text{where } b_1 = r\frac{s_y}{s_x} \text{ and } b_0 = \bar{y} - b_1\bar{x}$$

Inference about simple linear regression The test statistic for $H_0 : \beta_1 = 0$ is

$$t = \frac{b_1}{SE_{b_1}} = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \sqrt{F} = \sqrt{\frac{MSM}{MSE}}$$

Recall also that $r^2 = \frac{SSM}{SST}$, $r^2_{\text{adj}} = 1 - \frac{MSE}{MST}$, and $MST = s_y^2$.

Standard Errors for Regression Confidence and Prediction Intervals

$$SE_{\mu_y} = s\sqrt{\frac{1}{N} + \frac{b_1^2(x-\bar{x})^2}{MSM}} \text{ and } SE_{\hat{y}} = s\sqrt{1 + \frac{1}{N} + \frac{b_1^2(x-\bar{x})^2}{MSM}}$$

where $s = \sqrt{MSE}$ is the standard error of the residuals.

Inference in ANOVA Use the pooled standard deviation $s_p = \sqrt{MSE}$ as the best guess for σ.

Recall also that $SSG = \sum_{i=1}^{I} N_i(\bar{x}_i - \bar{x})^2$ and $SSE = \sum_{i=1}^{I}(N_i - 1)s_i^2$.

For a contrast $C = \sum_i a_i\bar{x}_i$ the standard error is $SE_C = s_p\sqrt{\sum \frac{a_i^2}{N_i}}$.