Things to know and formulas for Exam 1

- Three decisions.
- Three sources of variability.
- Three types of variability.
- Control, Replication, and Randomization.
- How to use the sample size tables.
- How to interpret computer output.

Two independent Sample Problem
Equal Variance Condition

\[ s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{(n_1 + n_2 - 2)} \text{ with } df = n_1 + n_2 - 2 \]

\[ t = \frac{(\bar{Y}_{1+} - \bar{Y}_{2+})}{s_p \sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \]

\[ (\bar{Y}_{1+} - \bar{Y}_{2+}) \pm t \ast s_p \sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)} \]

Analysis of Variance, 1-Factor with k levels

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>Sums of Squares</th>
<th>Mean Square</th>
<th>F-Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor</td>
<td>k - 1</td>
<td>[ \sum n_i (\bar{Y}<em>{i+} - \bar{Y}</em>{++})^2 ]</td>
<td>[ \frac{SS_{\text{Factor}}}{(k - 1)} ]</td>
<td>[ \frac{MS_{\text{Factor}}}{MS_{\text{Error}}} ]</td>
</tr>
<tr>
<td>Error</td>
<td>N - k</td>
<td>[ \sum (n_i - 1)s_i^2 ]</td>
<td>[ \frac{SS_{\text{Error}}}{(N - k)} ]</td>
<td></td>
</tr>
<tr>
<td>C. Total</td>
<td>N - 1</td>
<td>[ \sum \sum (Y_{ij} - \bar{Y}_{++})^2 ]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[ R^2 = \frac{SS_{\text{Factor}}}{SS_{\text{C.Total}}} \]

\[ \hat{t}_i = \bar{Y}_{i+} - \bar{Y}_{++} \]
Multiple Comparisons, LSD

$t^*$ has $df = df_{\text{Error}}$ and 95% confidence for each comparison

$$LSD = t^* \sqrt{MS_{\text{Error}} \left( \frac{1}{n_i} + \frac{1}{n_j} \right)}$$

$$|\bar{Y}_{i+} - \bar{Y}_{j+}| > LSD$$ then the difference in sample means is statistically significant $t$

Confidence interval for the difference in two means

$$\left( \bar{Y}_{i+} - \bar{Y}_{j+} \right) \pm LSD$$

Analysis of Residuals

To check for equality of standard deviations, plot residuals versus treatments and compute the standard deviation of the residuals for each treatment.

To check for normality, look at the distribution of residuals.