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

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

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

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

Analysis of Variance, I-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_{Factor}}{(k - 1)} )</td>
<td>( \frac{MS_{Factor}}{MS_{Error}} )</td>
</tr>
<tr>
<td>Error</td>
<td>N – k</td>
<td>( \sum (n_i - 1)s_i^2 )</td>
<td>( \frac{SS_{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>

\[ R^2 = \frac{SS_{Factor}}{SS_{C.\,Total}} \]
Multiple Comparisons, LSD

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

\[
LSD = t^* \sqrt{MS_{Error}} \sqrt{\frac{1}{n_i} + \frac{1}{n_j}}
\]

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

Confidence interval for the difference in two means

\[
(\bar{Y}_{i+} - \bar{Y}_{j+}) \pm LSD
\]

Multiple Comparisons, HSD

\( q^* \) and 95% confidence for the set of comparisons

\[
HSD = q^* \sqrt{MS_{Error}} \sqrt{\frac{1}{n_i} + \frac{1}{n_j}}
\]

\( |\bar{Y}_{i+} - \bar{Y}_{j+}| > HSD \) then the difference in sample means is statistically significant