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

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

$$\left(\overline{Y}_1 - \overline{Y}_2\right) \pm t^* \sqrt{s_p^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

$$t = \frac{\left(\overline{Y}_1 - \overline{Y}_2\right)}{\sqrt{s_p^2\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

Analysis of Variance, 1-Factor with k levels

Source	df	Sums of Squares	Mean Square	F
Model	k–1	$\sum_{i=1}^{k} n_i(\overline{Y}_{i+} - \overline{Y}_{++})^2$	SS_{Model}/df_{Model}	$\frac{MS_{Model}}{MS_{Error}}$
Error	N–k	$\sum_{i=1}^{k}(n_i - 1)s_i^2$	SS_{Error}/df_{Error}	
C. Total	N–1	$\sum\sum(Y_{ij} - \overline{Y}_{++})^2$		

Multiple Comparisons, LSD

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

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

Multiple Comparisons, adjLSD or Bonferroni

t^* has $df = df_{Error}$ and 99% or higher confidence for each comparison.
Confidence coefficient for each comparison $= 1 - \frac{0.05}{\left(\frac{k(k-1)}{2}\right)}$

$$adjLSD = t^* \sqrt{MS_{Error}} \sqrt{\frac{1}{n_i} + \frac{1}{n_j}}$$

Factorial Crossing - Multifactor ANOVA

Factor A: a levels, Factor B: b levels, n replicates per treatment combination.

Source	df	Sums of Squares	Mean Square	F
Factor A	a–1	$\sum bn(\overline{Y}_{i++} - \overline{Y}_{+++})^2$	$\frac{SS_A}{a-1}$	$\frac{MS_A}{MS_{Error}}$
Factor B	b–1	$\sum an(\overline{Y}_{+j+} - \overline{Y}_{+++})^2$	$\frac{SS_B}{b-1}$	$\frac{MS_B}{MS_{Error}}$
AB Interaction	(a-1)(b-1)	subtraction	$\frac{SS_{AB}}{(a-1)(b-1)}$	$\frac{MS_{AB}}{MS_{Error}}$
Model	ab–1	$\sum\sum n(\overline{Y}_{ij+} - \overline{Y}_{+++})^2$	SS_{Model}/df_{Model}	$\frac{MS_{Model}}{MS_{Error}}$
Error	ab(n-1)	$\sum\sum(n-1)s_{ij}^2$	SS_{Error}/df_{Error}	
C. Total	abn–1	$\sum\sum\sum(Y_{ijk} - \overline{Y}_{+++})^2$		