Chapter 9: Comparing Three or More Group Means: The One-Way Between Subjects Analysis of Variance (ANOVA)

Statistical Concept	Plain English Description	Mathematical Formula
Sums of squares	Sum of the squared deviations from the group mean	$\Sigma(x - M)^2$
Total sums of squares	Sum of the squared deviation of each score in the entire dataset from the grand mean in a dataset	$\sum(x - \text{grand mean})^2$
Within-groups sums of squares	Sum of the squared deviation of each score within a group from its group mean	$\sum(x - \text{group mean})^2$
Between-groups sums of squares	Sum of the squared deviation of each group mean from the grand mean	$\sum(\text{group mean} - \text{grand mean})^2$
Total degrees of freedom	Total sample size minus 1	df_{total} = sample size – 1
Within-groups degrees of freedom	Total sample size minus the number of groups being compared	$df_{within\text{-}groups}$ = sample size – number of groups in the ANOVA
Between-groups sums of squares	Number of groups being compared minus 1	$df_{between}$-groups = number of groups in the ANOVA – 1
Mean Square (MS)	Sums of squares divided by degrees of freedom	$MS = \frac{\text{Sums of squares}(SS)}{df}$
Mean Square within-group	Within-groups sums of squares divided by within-groups degrees of freedom	$SS_{within\text{-}groups}/df_{within\text{-}groups}$
Mean Square between-groups	Between-groups sums of squares divided by between-groups sums of squares	$SS_{between\text{-}groups}/df_{between\text{-}groups}$
F ratio test statistic	Mean Square between-groups divided by mean square within-groups	$MS_{between\text{-}groups}/MS_{within\text{-}groups}$
Effect size (partial eta squared)	Between-groups sums of squares divided by between-groups sums of squares plus within-groups sums of squares	$\eta_p^2 = \frac{SS_{between\text{-}groups}}{SS_{between\text{-}groups} + SS_{within\text{-}groups}}$
Honestly Significant Difference (HSD)	Square root of mean square within-groups divided by the number of participants in each group, all multiplied by a constant (Q)	$HSD = Q \times \sqrt{\frac{MS_{within\text{-}groups}}{\text{number of participants in each group}}}$