
# 6 — ANOVA continued

## 6.1 Means

**Definition 6.1 — Group Means.** The group means are the individual mean for each group in an Anova test.

**Definition 6.2 — Mean Squares.** The $MS_{between}$ and $MS_{within}$ are computed as:

$$MS_{between} = \frac{SS_{between}}{df_{between}}$$

$$MS_{within} = \frac{SS_{within}}{df_{within}}$$

## 6.2 Tukey's HSD

**Definition 6.3 — Tukey's HSD.** Tukey's HSD allows us to make pairwise comparisons to determine if a significant difference occurs between means. If Tukey's HSD is greater than the difference between sample means then we consider the samples significantly different. Keep in mind that the sample sizes must be equal. Tukey's HSD is computed as:

$$q^* \sqrt{\frac{MS_{within}}{n}}$$

We can also use Cohen's d for multiple comparisons on sample sets. Using Cohen's d we have to compute the value for every possible combination of samples.

**Definition 6.4 — $\eta^2$.** $\eta^2$ (read eta squared) is the proportion of total variation that is due to between group differences.

$$\eta^2 = \frac{SS_{between}}{SS_{within} + SS_{between}} = \frac{SS_{between}}{SS_{total}}$$

R The value of $\eta^2$ is considered large if it is greater than 0.14

## 6.3 Practice Problems

**Problem 6.1** Amy is trying to set-up a home business of selling fresh eggs. In order to increase her profits, she wants to only use the breed of hens that produce the most eggs. She decides to run an experiment testing four different breeds of hens, counting the number of eggs laid by each breed. She purchases 10 hens of each breed for her experiment. What is the studentized range statistic (q*) for this experiment at an alpha level of 0.05?

**Problem 6.2** Amy finds that the MSwithin for the first batch of eggs laid by her hens to be 45.25. How far apart do the group means for the different breeds have to be to be considered significant?

**Problem 6.3** Amy also finds that SSwithin = 1629.36 and SSbetween= 254.64. What proportion of the total variation in the number of eggs produced by each breed can be attributed to the different breeds? (Calculate eta-squared)

**Problem 6.4** Using Tukey HSD, are the sample means significantly different?