

Worksheet 19 - ANOVA test stat

Monday, April 6, 2026

Math 58B - Jo Hardin

Name: _____

Names of people you worked with: _____

What are you most excited to do this summer?

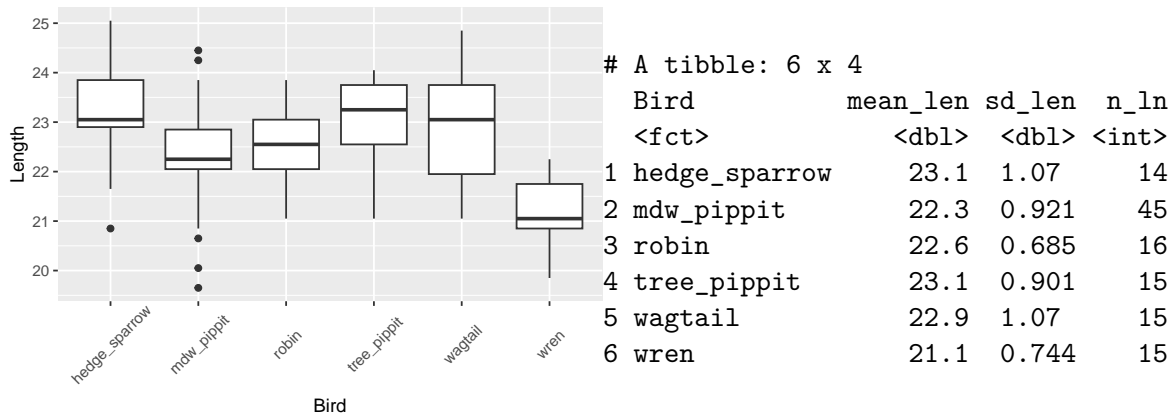
Task: Consider a situation where you want to test whether the cuckoo egg lengths differ across host species of bird (on average). That is, you'd like to test the null hypothesis:

$$H_0 : \mu_{HS} = \mu_{MP} = \mu_{RB} = \mu_{TP} = \mu_{WG} = \mu_{WN}$$

The test statistic used when comparing **two** means was a t score.

$$T = \frac{(\bar{X}_1 - \bar{X}_2) - 0}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

How might you generalize the t score so as to compare differences in sample means in the numerator and variability within a sample in the denominator. Brainstorm with your peers and try to come up with a single test statistic for the cuckoo bird problem at hand.



Solution:

The ANOVA test statistic is:

$$F = \frac{\frac{\sum_{i=1}^I n_i (\bar{x}_i - \bar{x})^2}{I-1}}{\frac{\sum_{i=1}^I s_i^2 (n_i - 1)}{N-I}}$$

The key to understanding the ANOVA F test statistic is recognizing that the numerator compares how different the sample means are and the denominator summarizes the extent of the variability within each group.

That said, the reason we use the F test stat is because of its mathematical properties. There are other statistics we could use which would also capture the difference in means!