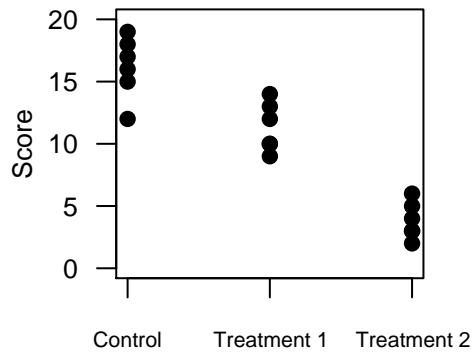


Investigators evaluated two new treatments for allergies with a control treatment. There were a total of eighteen subjects, randomly divided with six subjects receiving each treatment. Allergy symptoms were scored for each subject on a scale from 1 to 20 with larger scores indicating worse symptoms. A dotplot of the data appears to the right.



	Control	Trt. 1	Trt. 2
mean	16.17	11.33	3.83
SD	2.48	1.97	1.47
n	6	6	6

Source	df	SS	MS	F-statistic	P-value
Between		463.44			9.8×10^{-8}
Within					
Total		524.44			

(a) Complete the ANOVA table.

Solution:

Source	df	SS	MS	F-statistic	P-value
Between	2	463.44	231.72	56.98	9.8×10^{-8}
Within	15	61.0	4.07		
Total	17	524.44			

(b) Find s_{pooled} , the pooled estimate of the common standard deviation.

Solution: $s_{pooled} = \sqrt{4.07} = 2.02$.

(c) Use the Newman-Keuls method to make all pairwise comparisons of treatment means.

Solution: Scale factor is $\frac{2.02}{\sqrt{6}} = 0.824$.

	2	3
q_i	3.01	3.67
R_i	2.48	3.02

Control – Treatment 2	12.43	± 3.03
Control – Treatment 1	4.84	± 2.48
Treatment 1 – Treatment 2	7.50	± 2.48

All differences are significant.

(d) Use the Bonferroni method to make all pairwise comparisons of treatment means.

Solution: There are fifteen degrees of freedom, three comparisons, so $t = 2.694$. Margin of error is $2.694 \times 2.02 \times \sqrt{\frac{1}{6} + \frac{1}{6}} = 3.14$. All pairwise differences are larger, so all are significant.

(e) Circle the numbers of all correct statements.

(1) Since the sample sizes are small, the data is consistent with the population mean allergy symptom scores being equal.

Solution: False. We can draw conclusions with small samples.

- (2) There is strong evidence that Treatment 2 is the most effective and that Treatment 1 is better than the Control treatment.

Solution: True. This is the conclusion of both Newman-Keuls and Bonferroni analyses.

- (3) The ANOVA procedure is not reliable because the sample standard deviations are not all equal.

Solution: False. ANOVA is robust to minor variation in standard deviation. The sample standard deviations are similar.

- (4) The dot plot of the data is consistent with the ANOVA assumptions of normality and equal variance.

Solution: True. Spreads look similar and only potential outliers are mild. No obvious strong skewness.

- (5) In this example, the Bonferroni method is more conservative than the Newman-Keuls method.

Solution: True. The Bonferroni criterion for rejection (margin if error) is larger than that for Newman-Keuls — $3.14 > 3.02 > 2.48$.