

Problem 1.

Calculate the between and within df for the following conditions.

Part (a)

Five conditions (e.g., placebo, dose 1, dose 2, dose 3, and dose 4) with $N = 100$?

$$\begin{aligned}df_{\text{between}} &= 4 \\df_{\text{within}} &= N - df_{\text{between}} - 1 \\&= 100 - 4 - 1 = 95\end{aligned}$$

Part (b)

Three conditions with $N = 45$?

$$\begin{aligned}df_{\text{between}} &= 2 \\df_{\text{within}} &= N - df_{\text{between}} - 1 \\&= 45 - 2 - 1 = 42\end{aligned}$$

Part (c)

Eight conditions with $N = 200$?

$$\begin{aligned}df_{\text{between}} &= 7 \\df_{\text{within}} &= N - df_{\text{between}} - 1 \\&= 200 - 7 - 1 = 192\end{aligned}$$

Part (d)

Four conditions with $N = 36$?

$$\begin{aligned}df_{\text{between}} &= 3 \\df_{\text{within}} &= N - df_{\text{between}} - 1 \\&= 36 - 3 - 1 = 32\end{aligned}$$

Problem 2.

Use the F-table provided in the hw05 folder on smartsite.

Part (a)

What is the critical F-value given an alpha of .05 and df between of 2 and df within of 20?

3.49

Part (b)

What is the critical F-value given an alpha of .05 and df between of 4 and df within of 30?

2.69

Part (c)

What is the critical F-value given an alpha of .05 and df between of 3 and df within of 100?

2.70

Part (d)

What is the critical F-value given an alpha of .01 and df between of 5 and df within of 50?

3.41

Problem 3.

In your own words, explain what the between and within SS from an ANOVA table represents? Why do you think these values are divided by their respective df in order to estimate MS and then the F value? Why does the one-way ANOVA not help researchers understand where differences between conditions are, but can be used to determine if there are significant differences between conditions?

The $SS_{between}$ and SS_{within} from the ANOVA tables represent the amount of variation between groups and the amount of variation between all subjects. These values are divided by their respective df in order to normalize the values against one another. If we did not do this renormalization it would give undo weight to one or the other SS values. The F value from the ANOVA table (and ultimately the p value), tell the researcher that there is a significant deviation away from H_0 for the groups and the subjects. As H_0 is the assumption that all the groups have the same variation, the opposite is then true—that all the groups do not have the variation. This statement does not indicate which groups are different, and nothing about one-way ANOVA selects any particular group for comparison. Due to this, post-hoc tests are used to look at the differences between selected groups.

Problem 4.

Complete by hand, you may use a calculator, show all work. For intermediary calculations (e.g., mean and sd) round to four decimal places. Round your final answer to two decimal places.

Source	df	SS	MS	F	P
Between		2510.5			
Within	12				
Total	14	2671.7			

$$\begin{aligned}
df_{total} &= df_{between} + df_{within} & \implies df_{between} &= 14 - 12 = 2 \\
SS_{total} &= SS_{between} + SS_{within} & \implies SS_{within} &= 2671.7 - 2510.5 = 161.2 \\
MS_{between} &= \frac{SS_{between}}{df_{between}} & \implies MS_{between} &= \frac{2510.5}{2} = 1255.25 \\
MS_{within} &= \frac{SS_{within}}{df_{within}} & \implies MS_{within} &= \frac{161.2}{12} = 13.4333 \\
F &= \frac{MS_{between}}{MS_{within}} & \implies F &= \frac{1255.25}{13.4333} = 93.4432
\end{aligned}$$

Using the F-table provided for this assignment, with $df_{numerator} = 2$ and $df_{denominator} = 12$, we see that $F = 93.4432 > 12.97$, suggesting a $p < .001$. The table can then be completed as:

Source	df	SS	MS	F	P
Between	2	2510.50	1255.25	93.44	< .001
Within	12	161.20	13.43		
Total	14	2671.70			

Problem 5.

Source	df	SS	MS	F	P
Between		16			
Within	95		1.2		
Total	99				

$$\begin{aligned}
df_{total} &= df_{between} + df_{within} & \implies df_{between} &= 99 - 95 = 4 \\
SS_{within} &= MS_{within} * df_{within} & \implies SS_{within} &= 1.2 * 95 = 114 \\
SS_{total} &= SS_{between} + SS_{within} & \implies SS_{total} &= 16 + 114 = 130 \\
MS_{between} &= \frac{SS_{between}}{df_{between}} & \implies MS_{between} &= \frac{16}{4} = 4 \\
F &= \frac{MS_{between}}{MS_{within}} & \implies F &= \frac{4}{1.2} = 3.3333
\end{aligned}$$

Using the F-table provided for this assignment, with $df_{numerator} = 4$ and $df_{denominator} = 100(\approx 95)$, we see that $F = 3.3333 > 2.92$, suggesting $.010 < p < .025$. The table can then be completed as:

Source	df	SS	MS	F	P
Between	4	16	4.0	3.33	.010 < p < .025
Within	95	114	1.2		
Total	99	130			