

**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  $N = 100$ ?

$$\begin{aligned}df_{\text{between}} &= 5 \\df_{\text{within}} &= N - df_{\text{between}} - 1 \\&= 100 - 5 - 1 = 94\end{aligned}$$

**Part (b)**

Three conditions with  $N = 45$ ?

$$\begin{aligned}df_{\text{between}} &= 3 \\df_{\text{within}} &= N - df_{\text{between}} - 1 \\&= 45 - 3 - 1 = 41\end{aligned}$$

**Part (c)**

Eight conditions with  $N = 200$ ?

$$\begin{aligned}df_{\text{between}} &= 8 \\df_{\text{within}} &= N - df_{\text{between}} - 1 \\&= 200 - 8 - 1 = 191\end{aligned}$$

**Part (d)**

Four conditions with  $N = 36$ ?

$$\begin{aligned}df_{\text{between}} &= 4 \\df_{\text{within}} &= N - df_{\text{between}} - 1 \\&= 36 - 4 - 1 = 31\end{aligned}$$

**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?

**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  $df_{\text{numerator}} = 2$  and  $df_{\text{denominator}} = 12$ , 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 |    |     |   |   |

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

Using the F-table provided for this assignment, with  $df_{\text{numerator}} = 4$  and  $df_{\text{denominator}} = 100 (\approx 95)$ , 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 | .025 |
| Within  | 95 | 114 | 1.2 |      |      |
| Total   | 99 | 130 |     |      |      |