

7.9. Two-way nested parametric ANOVA with equal replicates

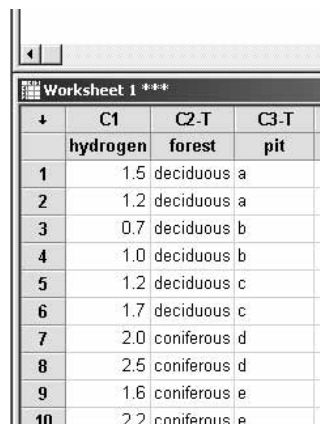
EXAMPLE 7.6. Hydrogen ion concentration in a deciduous and coniferous forest

BOX 7.9. How to carry out a nested ANOVA with one main factor and one nested factor, with equal replicates

Step 1. Enter your data into the worksheet section of the Minitab display. The hydrogen ion measurements go in the first column; the group (forest – coniferous or deciduous) goes in the second column; and the subgroup (pit identifier) goes in the third column.

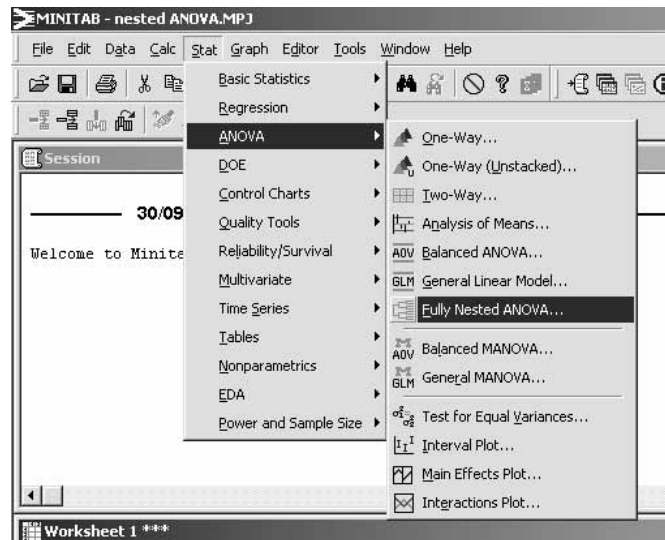
(Note that this test only works in Minitab for balanced data, i.e. data where you have equal numbers of measurements for each combination of treatments.)

Obviously there will be a lot of repeated entries in the ‘forest’ column: you can copy an entry down a column by hovering the cursor over the bottom right-hand corner of a cell until it changes from an open horizontal-vertical cross into an addition sign; when this happens, hold down the left mouse button, and drag the cursor down as far as you need.

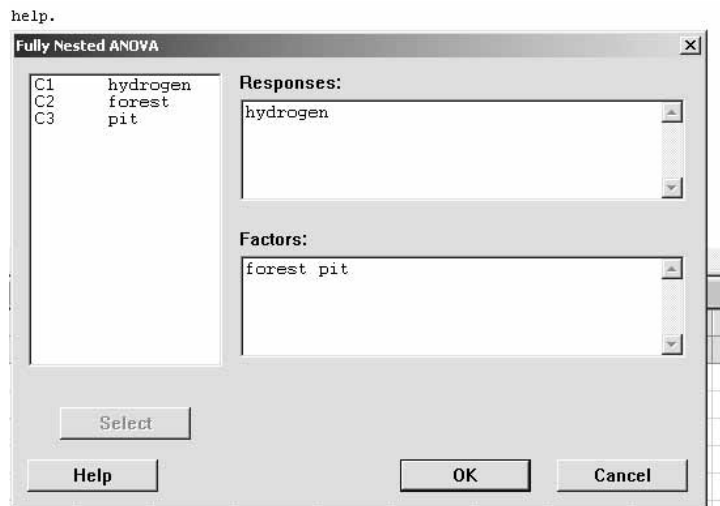


	C1	C2-T	C3-T
	hydrogen	forest	pit
1	1.5	deciduous	a
2	1.2	deciduous	a
3	0.7	deciduous	b
4	1.0	deciduous	b
5	1.2	deciduous	c
6	1.7	deciduous	c
7	2.0	coniferous	d
8	2.5	coniferous	d
9	1.6	coniferous	e
10	2.2	coniferous	e

Step 2. Perform the test. Go to 'Stat', 'ANOVA', 'Fully nested ANOVA'.



Transfer 'hydrogen' across into the 'Response' window by highlighting 'hydrogen', then clicking on 'Select'. Transfer 'forest' and then 'pit' across into the 'Factors' window. It is important that the factors are transferred across in the order in which they are nested.



Click on 'OK'. The results will appear in the session window.

Nested ANOVA: hydrogen versus forest, pit

Analysis of Variance for hydrogen

Source	DF	SS	MS	F	P
Forest	1	3.1008	3.1008	14.825	0.018
Pit	4	0.8367	0.2092	2.221	0.183
Error	6	0.5650	0.0942		
Total	11	4.5025			

Variance Components

Source	Var Comp.	% of Total	StDev
Forest	0.482	76.06	0.694
Pit	0.057	9.07	0.240
Error	0.094	14.86	0.307
Total	0.634		0.796

Expected Mean Squares

1 forest	1.00(3)	+	2.00(2)	+	6.00(1)
2 pit	1.00(3)	+	2.00(2)		
3 Error	1.00(3)				

Step 3. Decide what the results mean.

For the variation between forest types, the value of F is 14.825, and the associated p value is 0.018. This means that there is a significant difference at better than $p = 0.05$ between the hydrogen ion concentrations in the different forest soils.

For the variation between pits, the value of F is 2.221 and the associated p value is 0.183. There is no significant variation between the pits within a forest at $p = 0.05$.