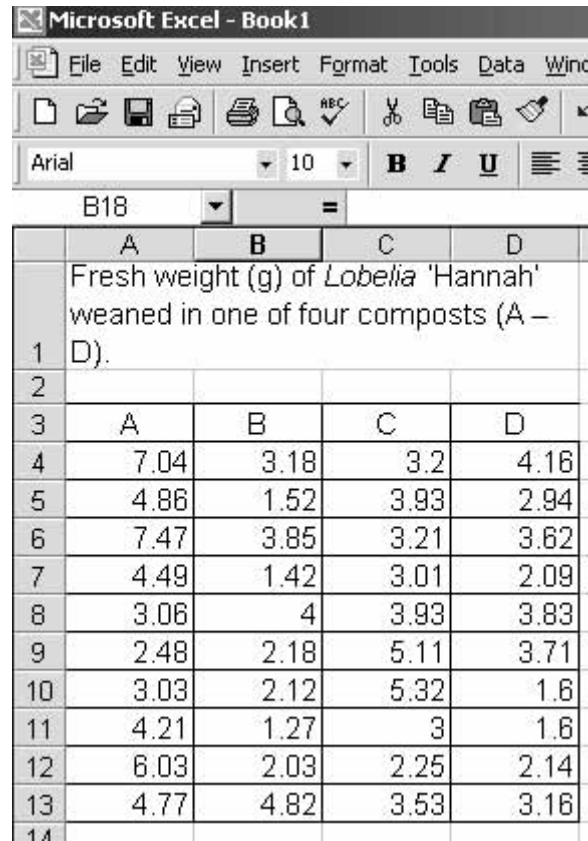


## 7.5. Parametric one-way ANOVA with equal numbers of replicates

**EXAMPLE 7.4.** The effectiveness of weaning plantlets of *Lobelia* 'Hannah' from tissue culture onto one of four composts

**BOX 7.5.** How to carry out an  $F_{\max}$  test to check for homogeneous variances, before carrying out an anova

Step 1. Open a new Excel spreadsheet and enter the data as below.



The screenshot shows a Microsoft Excel spreadsheet titled "Microsoft Excel - Book1". The spreadsheet contains data for the fresh weight (g) of *Lobelia* 'Hannah' weaned in one of four composts (A, B, C, D). The data is organized in a table with 14 rows and 5 columns. The first row is a header for the data, and the second row is a blank row. The third row is a header for the data, and the fourth row is a blank row. The data starts from row 5, column 2.

	A	B	C	D
1	Fresh weight (g) of <i>Lobelia</i> 'Hannah' weaned in one of four composts (A – D).			
2				
3	A	B	C	D
4	7.04	3.18	3.2	4.16
5	4.86	1.52	3.93	2.94
6	7.47	3.85	3.21	3.62
7	4.49	1.42	3.01	2.09
8	3.06	4	3.93	3.83
9	2.48	2.18	5.11	3.71
10	3.03	2.12	5.32	1.6
11	4.21	1.27	3	1.6
12	6.03	2.03	2.25	2.14
13	4.77	4.82	3.53	3.16
14				

**Step 2.** To confirm that the data may be analysed using a parametric ANOVA an  $F_{\max}$  test must be carried out first. The  $F_{\max}$  test can be performed indirectly by using the  $f_x$  paste function to find the variance for each sample.

Select a cell, say A15, in which the variance for the 'compost A' data will be returned. By pointing the cursor at the cell and clicking, the cell will become highlighted. Then click on  $f_x$  on the tool bar and the paste function dialogue box will open. Note too that an equal sign (=) appears in cell A15.

In the dialogue box, select 'Statistical' from the 'Function Category' list and 'VAR' from the 'Function Name' list. Click on OK. A box will now open in which the cells containing the data can be identified.

The screenshot shows Microsoft Excel with a data table and the VAR dialog box open. The data table is as follows:

	A	B	C	D
1	Fresh weight (g) of <i>Lobelia</i> 'Hannah' weaned in one of four composts (A – D).			
2				
3	A	B	C	D
4	7.04	3.18	3.2	4.16
5	4.86	1.52	3.93	2.94
6	7.47	3.85	3.21	3.62
7	4.49	1.42	3.01	2.09
8	3.06	4	3.93	3.83
9	2.48	2.18	5.11	3.71
10	3.03	2.12	5.32	1.6
11	4.21	1.27	3	1.6
12	6.03	2.03	2.25	2.14
13	4.77	4.82	3.53	3.16

The VAR dialog box is open, showing the following information:

- Number1: A4:A14 = {7.04;4.86;7.47;4.4
- Number2: = number
- Formula result = 2.846626667
- Estimates variance based on a sample (ignores logical values and text in the sample).
- Number1: number1,number2,... are 1 to 30 numeric arguments corresponding to a sample of a population.

The cells are identified by clicking on cell A4 and holding down the left mouse button, dragging down to cell B13. The cells will become highlighted and notice that the cell locations now show in the cell B15, as well as in the dialog box and on the formula bar.

Clicking 'OK' will return the variance value to the cell A15. By clicking on this box to highlight it, you will notice a small square at the bottom right-hand corner. Click on this and holding down the mouse button, drag along through cells B15, C15, and D15. The variances of samples B, C, and D will be given.

**Step 3.** To obtain  $F_{\max}$  select a new cell (B17), place an equals sign (=) in it, click on the cell containing the largest variance (A15), then type a forward slash (/), then click on the cell containing the smallest variance (C15), press 'return', and the ' $F_{\max}$  calculated' will be given (3.0942).

The screenshot shows a Microsoft Excel spreadsheet with the following data:

	A	B	C	D
1	Fresh weight (g) of <i>Lobelia</i> 'Hannah' weaned in one of four composts (A – D).			
2				
3	A	B	C	D
4	7.04	3.18	3.2	4.18
5	4.88	1.52	3.93	2.94
6	7.47	3.85	3.21	3.62
7	4.49	1.42	3.01	2.09
8	3.06	4	3.93	3.83
9	2.48	2.18	5.11	3.71
10	3.03	2.12	5.32	1.8
11	4.21	1.27	3	1.6
12	6.03	2.03	2.25	2.14
13	4.77	4.82	3.53	3.16
14				
15	2.846627	1.536832	0.919988	0.923072
16				
17	Fmax=	=A15/C15		
18				

This should be compared with the ' $F_{\max}$  critical' value given in the table of critical values (6.31). As ' $F_{\max}$  calculated' is less than ' $F_{\max}$  critical' a null hypothesis that states that there is no difference between the variances of the populations from which the samples are taken is not rejected; it is concluded that the variances of the samples are similar and that a one-way ANOVA can be performed to test for differences between the means of the samples.