

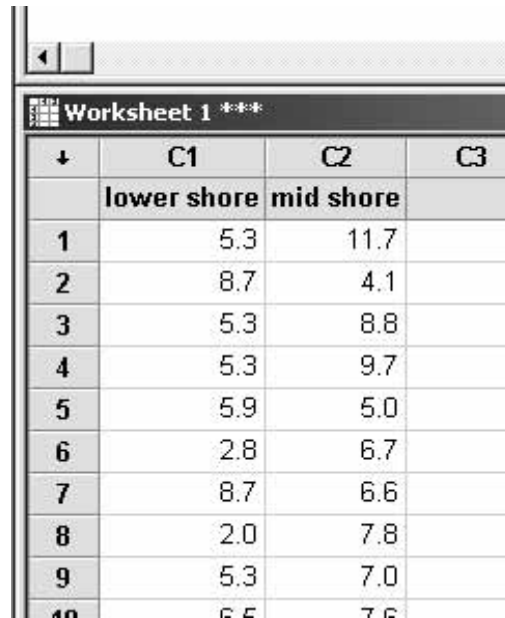
7.1. z test with unmatched data

EXAMPLE 7.1. The evolution of *Littorina littoralis* at Aberystwyth, 2002

BOX 7.1. How to carry out an f test to check for homogeneous variances before carrying out a z test for **unmatched** data

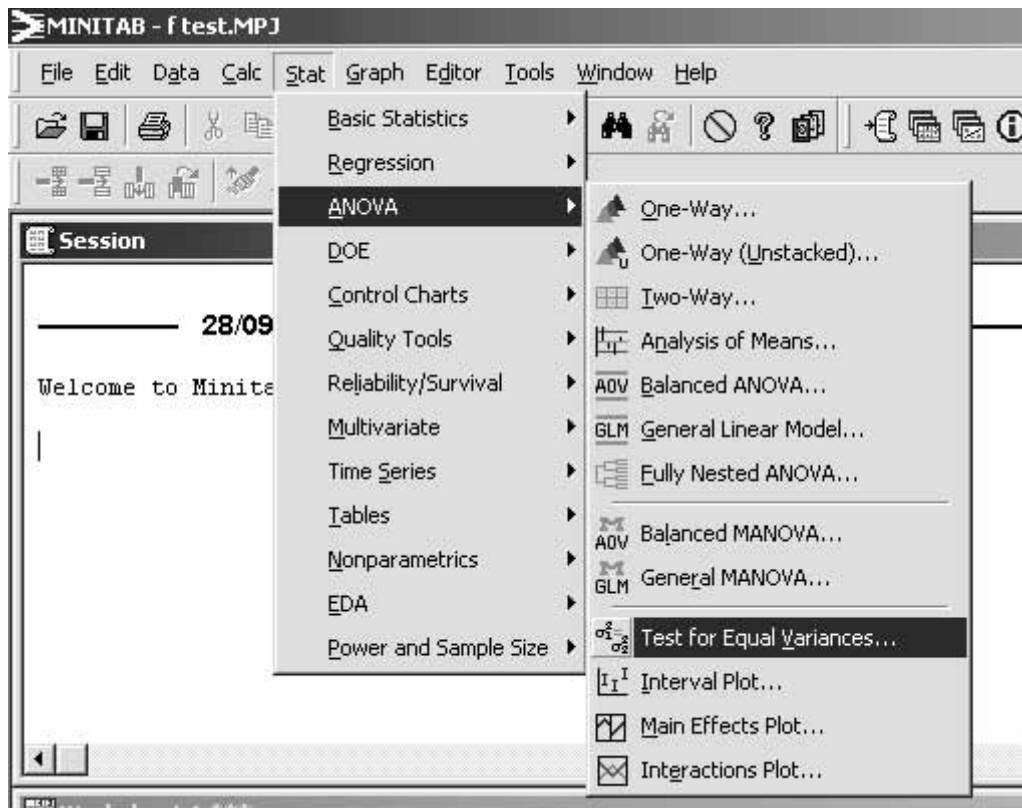
Minitab doesn't do a simple F test: rather, it implements Bartlett's and Levene's tests, which are not limited to only two data sets.

Step 1. Enter your data into the worksheet part of the Minitab display, using sensible headings for the columns.

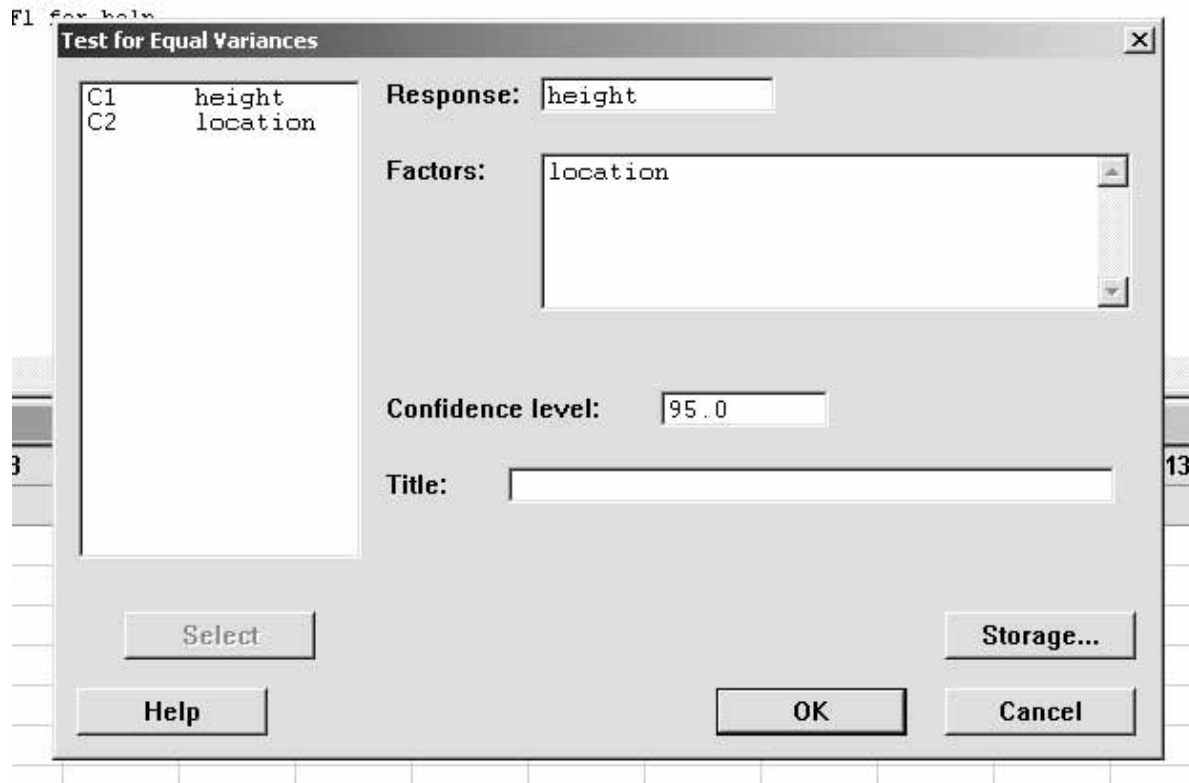


	C1	C2	C3
	lower shore	mid shore	
1	5.3	11.7	
2	8.7	4.1	
3	5.3	8.8	
4	5.3	9.7	
5	5.9	5.0	
6	2.8	6.7	
7	8.7	6.6	
8	2.0	7.8	
9	5.3	7.0	
10	6.5	7.6	

Step 2. Perform the test. Go to 'Stat', 'Anova', 'Tests for Equal Variance'.



Click in the 'Response' window, then highlight 'Height' in the left-hand window, and click on 'Select' to transfer it to the 'Response' window. Click in the 'Factor' window, and similarly transfer 'Location' from the left-hand window.



Click on 'OK'. The results will appear in the 'Session' window, and a graphical output will be produced in a separate window.

Test for Equal Variances: height versus location

95% Bonferroni confidence intervals for standard deviations

location	N	Lower	StDev	Upper
lower	30	1.46254	1.89477	2.66510
mid	30	1.56244	2.02419	2.84713

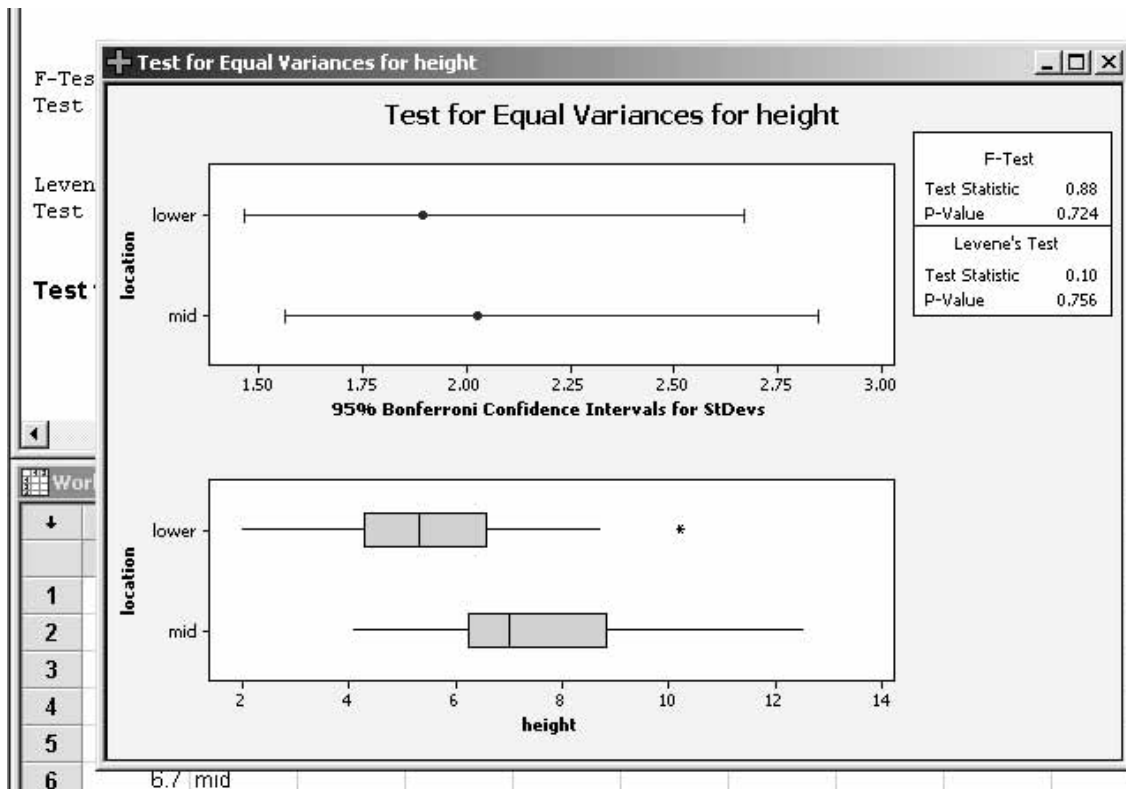
F-Test (normal distribution)

Test statistic=0.88, p-value=0.724

Levene's Test (any continuous distribution)

Test statistic=0.10, p-value=0.756

Test for Equal Variances for height



Step 3. Decide what the results mean.

Minitab calculates the F value as the ratio of the *smaller* standard deviation to the *larger* standard deviation, and so gives the reciprocal ($1/x$) of the value calculated in BOX 7.1. The p value is 0.724, which indicates that there is no significant difference ($p=0.05$) between the two variances.

The graphical output indicates that the distributions are slightly skewed, and therefore may not be normal: in this case, Levene's test would be more appropriate. The Levene test statistic is 0.10, and the corresponding p value is 0.756, which does not alter our conclusion.