

8.3. One-way non-parametric analysis of variance (ANOVA) (Kruskal–Wallis test): General hypotheses

EXAMPLE 8.2. The density of *Bellis perennis* (daisy) at four different locations on the University of Worcester campus, 2002

BOX 8.3. How to carry out a one-way non-parametric ANOVA (Kruskal–Wallis test): general hypotheses

Step 1. Set up the variables.

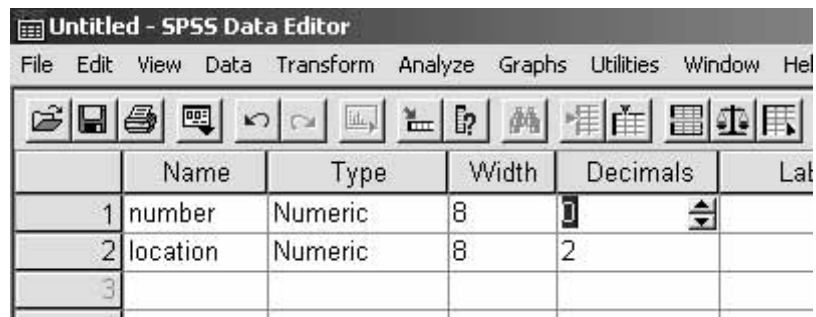
When SPSS starts up, select ‘Variable View’ using the tabs at the bottom left. You should get something like this:

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure
1										
2										
3										
4										
5										
6										

For the first variable name, type in ‘number’ (SPSS will not accept variable names unless the first character is a letter), and for the second ‘location’. Default properties will be set for each variable.

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure
1	number	Numeric	8	2		None	None	8	Right	Scale
2	location	Numeric	8	2		None	None	8	Right	Scale
3										
4										

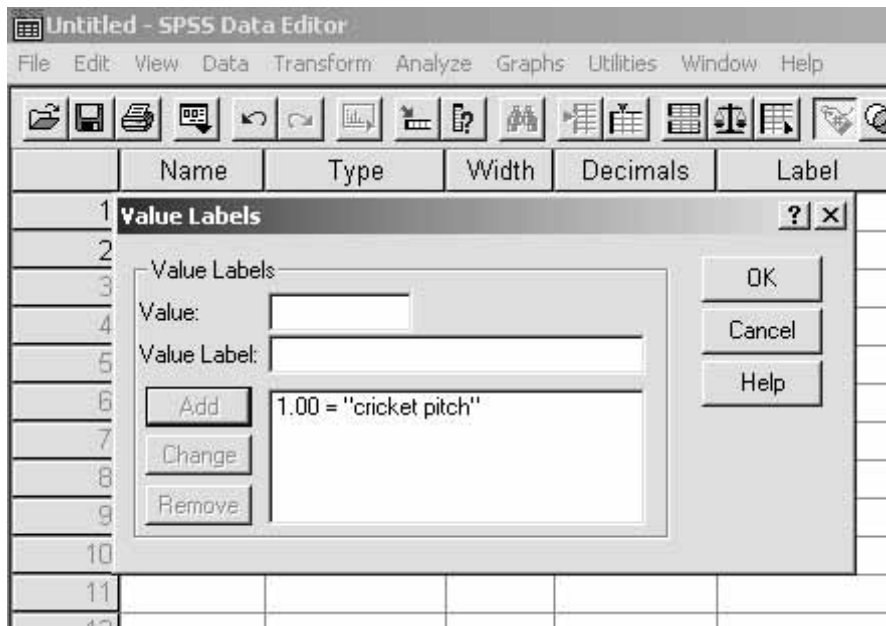
The number of *Bellis perennis* in a quadrat is going to be an integer, so change the ‘Decimals’ property of ‘number’ to zero by clicking in the ‘Decimals’ cell of row 1, and using the ‘up’ and ‘down’ arrows that appear to make the adjustment.



The screenshot shows the 'Untitled - SPSS Data Editor' window with a menu bar (File, Edit, View, Data, Transform, Analyze, Graphs, Utilities, Window, Help) and a toolbar. Below the toolbar is a table defining variables:

	Name	Type	Width	Decimals	Lat
1	number	Numeric	8	1	
2	location	Numeric	8	2	
3					

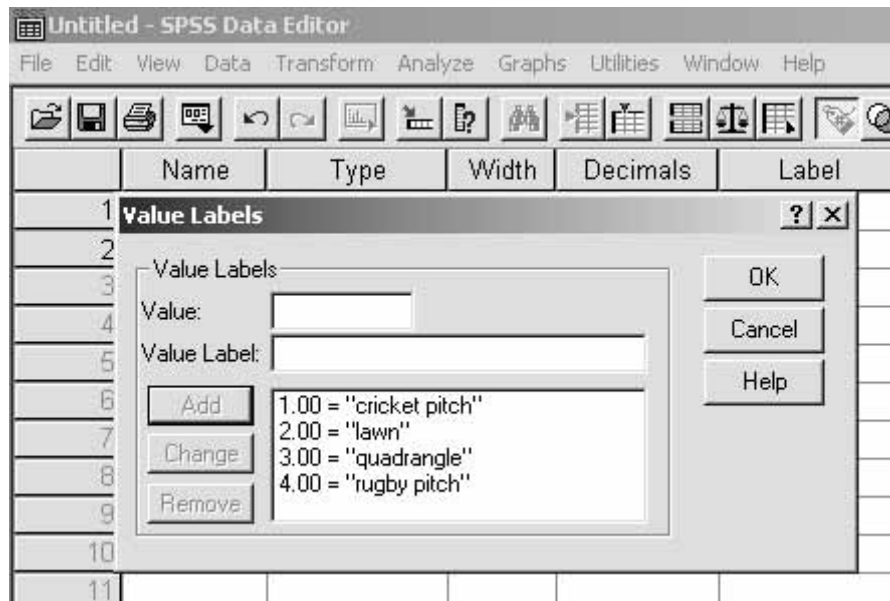
SPSS needs numbers for the variables here, so we need to use value labels for the location. Click in the 'Values' cell in row 2, and then click on the grey area that appears at the right-hand side of the cell. Type in a value of 1 and a value label 'cricket pitch'. Then click on 'Add' to register this pair with the system.



The screenshot shows the 'Untitled - SPSS Data Editor' window with the 'Value Labels' dialog box open for the 'location' variable. The dialog box has a title bar 'Value Labels' and a close button. It contains the following fields and buttons:

- Value Labels:** A list box containing one entry: "1.00 = 'cricket pitch'".
- Value:** An empty text input field.
- Value Label:** An empty text input field.
- Buttons:** 'Add', 'Change', 'Remove', 'OK', 'Cancel', and 'Help'.

Repeat for values of 2, 3, and 4, and value labels of 'lawn', 'quadrangle', and 'rugby pitch'.



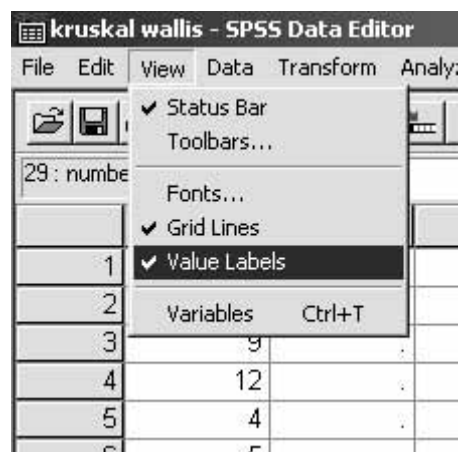
Click on 'OK'.

Since we have values that are integers, we can change the 'Decimals' property of 'location' to zero in the same way that we did for 'number'. Transfer to 'Data View' using the tabs at the bottom left.

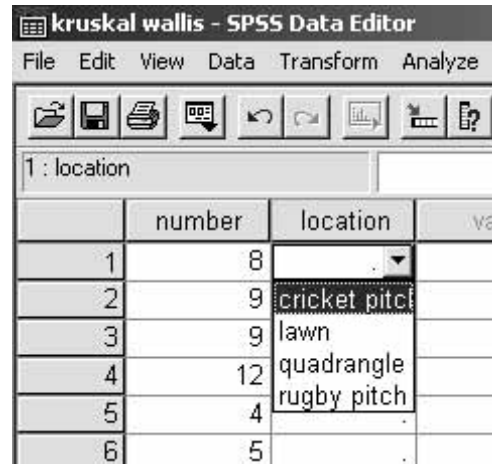
Step 2. Enter the data.

First, put the numbers into the 'number' column: this has to be done before the data labels can be used. If your data are in a Word table or an Excel spreadsheet, then some copying and pasting might be useful.

To insert the value labels, first go to the 'View' menu and checking that there is a tick beside 'Value Labels'.



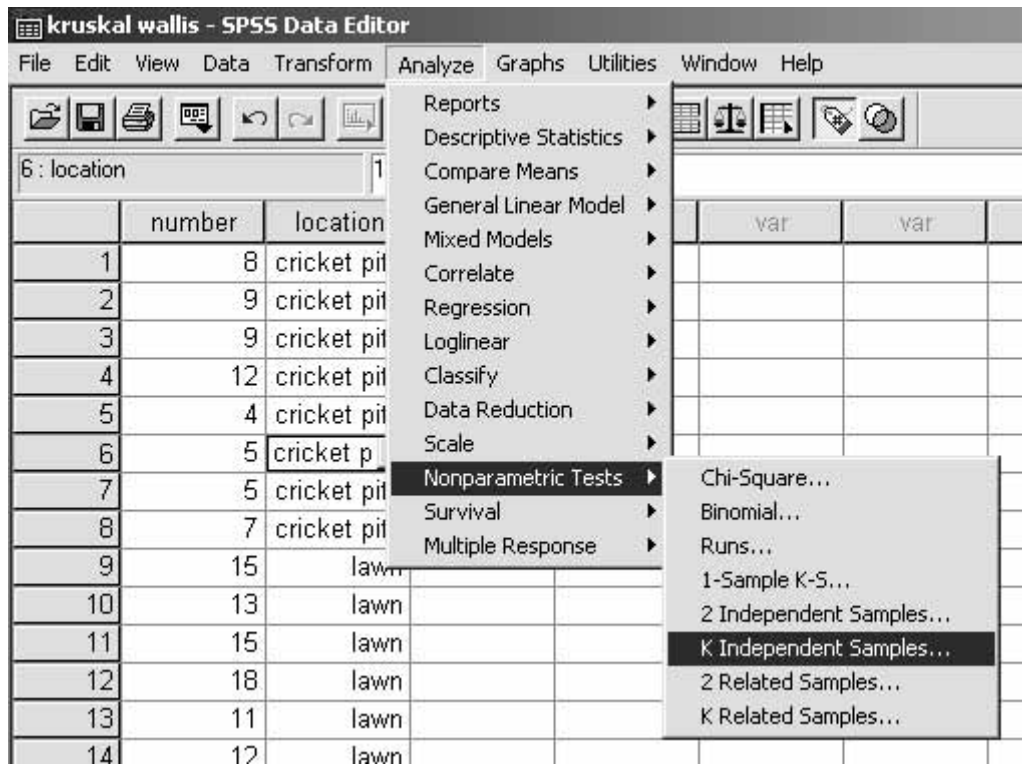
Next, click in the first cell of the 'location' column. A drop-down menu should appear at the right-hand side of the cell, from which you can select the appropriate option.



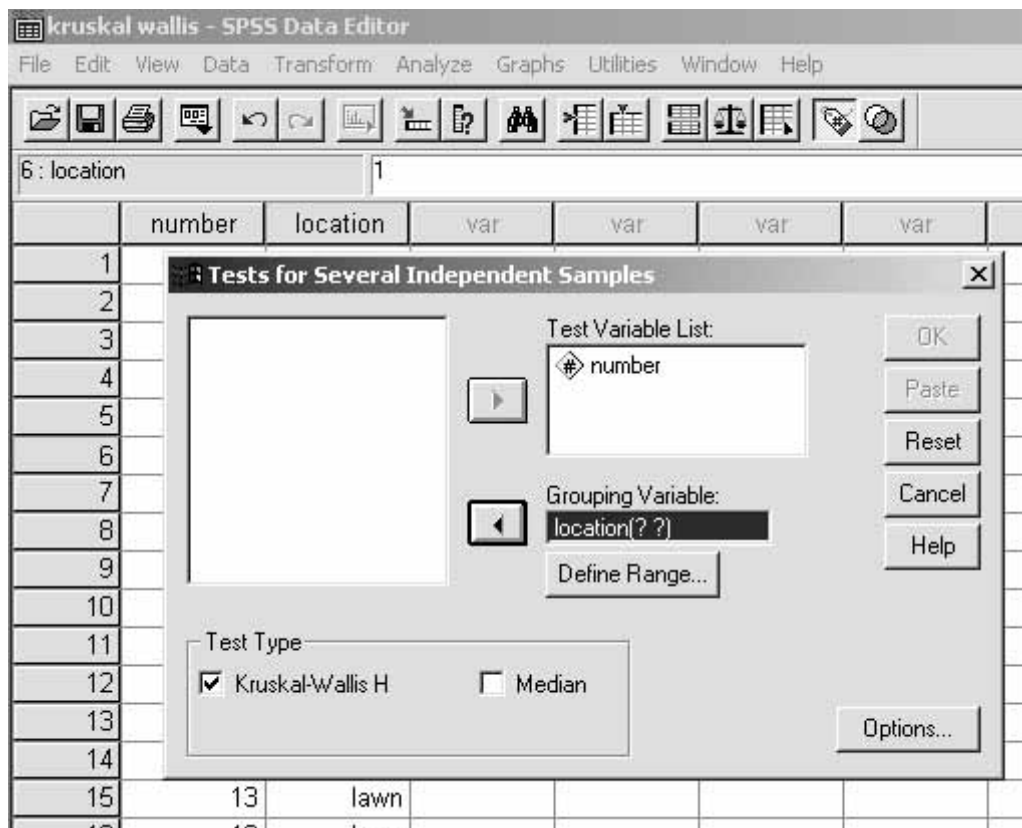
Repeat for all other 'location' cells – some more copying and pasting?

Step 3. Perform the test.

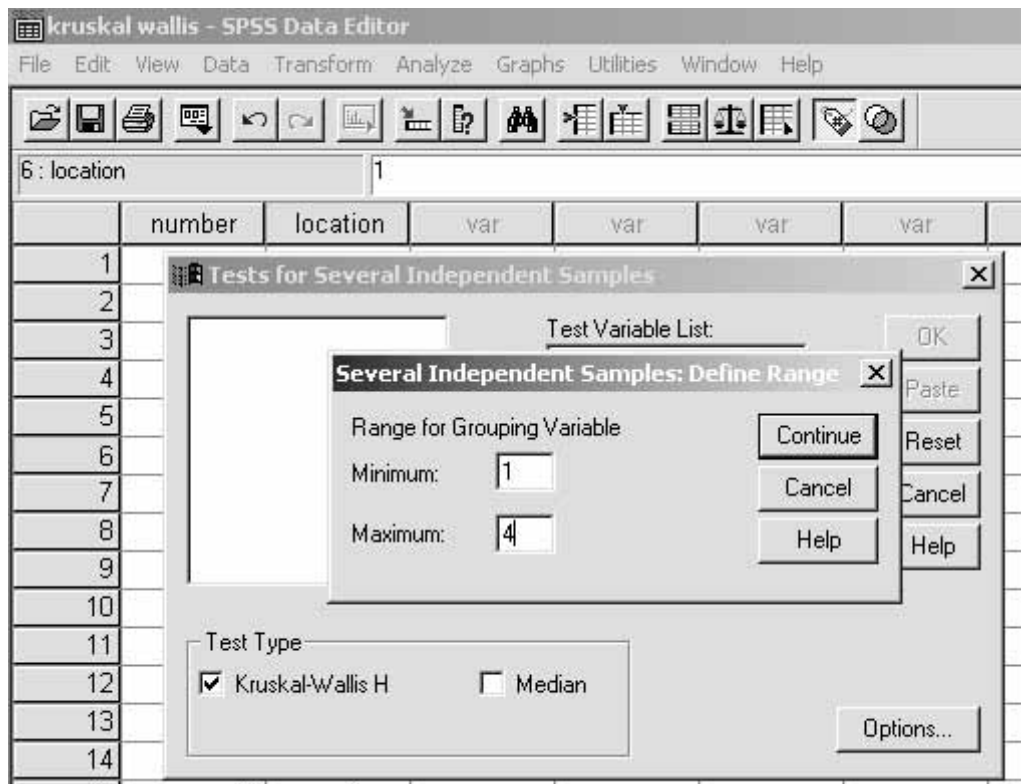
Go to 'Analyze', 'Nonparametric Tests', 'K **Independent** Samples'.



Click on 'number' to highlight it, then click on the appropriate arrow to transfer it across to the 'Test Variable List' window. In the same way, transfer 'location' to the 'Grouping Variable' window.



Click on 'Define Range'. This defines the numerical range of the grouping variable, in this case from 1 to 4 (the values we input at the beginning).



Click on 'Continue', and then on 'OK'. The results will appear in a separate window.

NPar Tests
Kruskal–Wallis Test

Kruskal–Wallis Test

Ranks

	LOCATION	N	Mean Rank
NUMBER	cricket pitch	8	7.00
	lawn		23.13
	quadrangle	8	21.06
	rugby pitch	8	14.81
	Total	32	

Test Statistics(a,b)

	NUMBER
Chi-Square	14.508
df	3
Asymp. Sig.	.002

a Kruskal Wallis Test

b Grouping Variable: LOCATION

Step 4. Decide what the results mean.

[The software makes a correction for ties that haven't been done in the book: the difference in this case is small. See, for example, Sokal, R. R. and Rohlf, F. J. *Biometry*, 3rd edition, Freeman, 1995, pp. 423–427 for details.]

The value of the test statistic H (called K in the book) is 14.58, and the 'Asymp. Sig' is 0.002, which is less than 0.05. We therefore conclude that there is a significant difference between the **median** densities of *Bellis perennis* at the four locations sampled.