Lab #8.

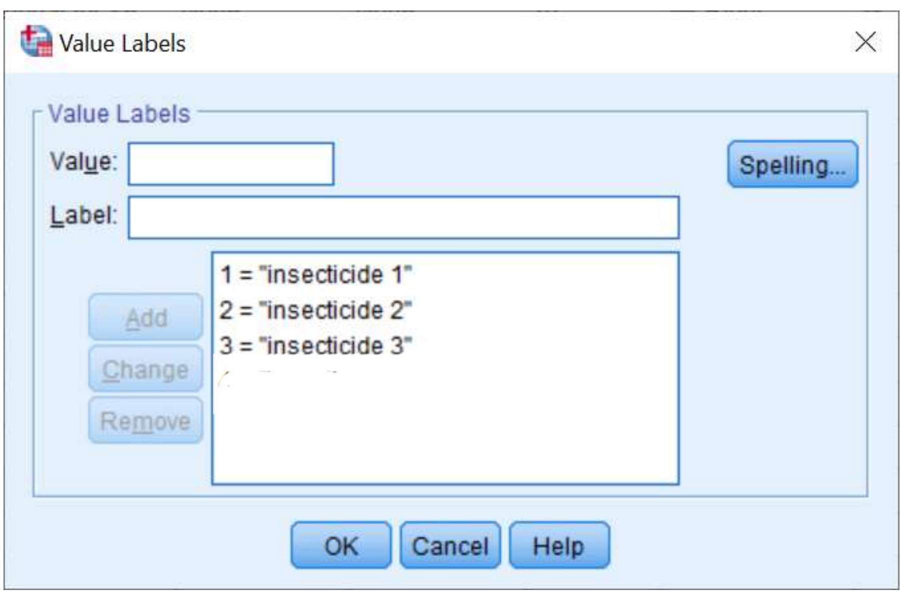
For the Insecticide/Plot example, we need three variables: seedlings (the response variable), insecticide (the treatment variable) and plot (the block variable).

> An experiment was conducted to compare the effects of 3 different insecticides on particular variety of string beans. Four different plots were prepared, with each plot subdivided into three rows. A suitable distance was maintained between the rows within a plot. Each row was planted with 100 seeds and then maintained under the insecticide assigned to the row. The insecticides were randomly assigned to the rows within a plot so that each insecticide appeared in one row in all four plots. The response of interest was the number of seedlings that emerged per row. The data is below:

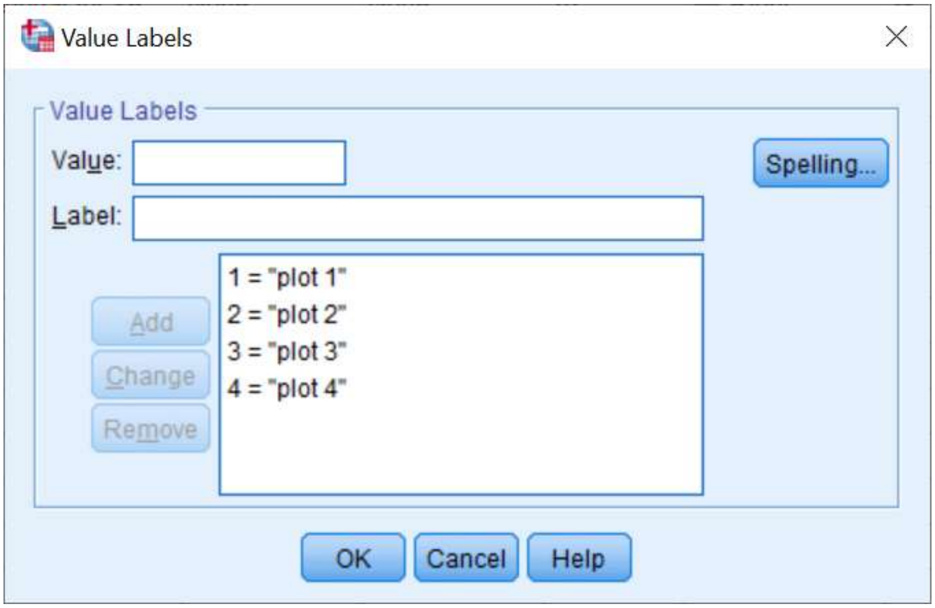
	Plot			
Insecticide	**1**	**2**	**3**	**4**
1	56	49	65	60
2	84	78	94	93
3	80	72	83	85

Enter the name of the variable in the field labelled “Name”, in the “Type” keep the default option ‘numeric’. Next you can choose the “Width” of your variable and how many decimals it should have under “Decimals” (it is set by default to width=8 and decimals=2). The “Label” and “Values” fields are filled for treatment variable, so skip them for the response variable. The last field that should be filled is “Measure”. Since the lifetime is the response variable of quantitative type, set it to ‘scale’.

For the factor 1 (i.e. treatment) variable, we repeat: “Name” = insecticide, we have no need for decimals here since the insecticides are numbered 1,2,3. Next we click on “Values” and here we can label/code each insecticide as we wish.



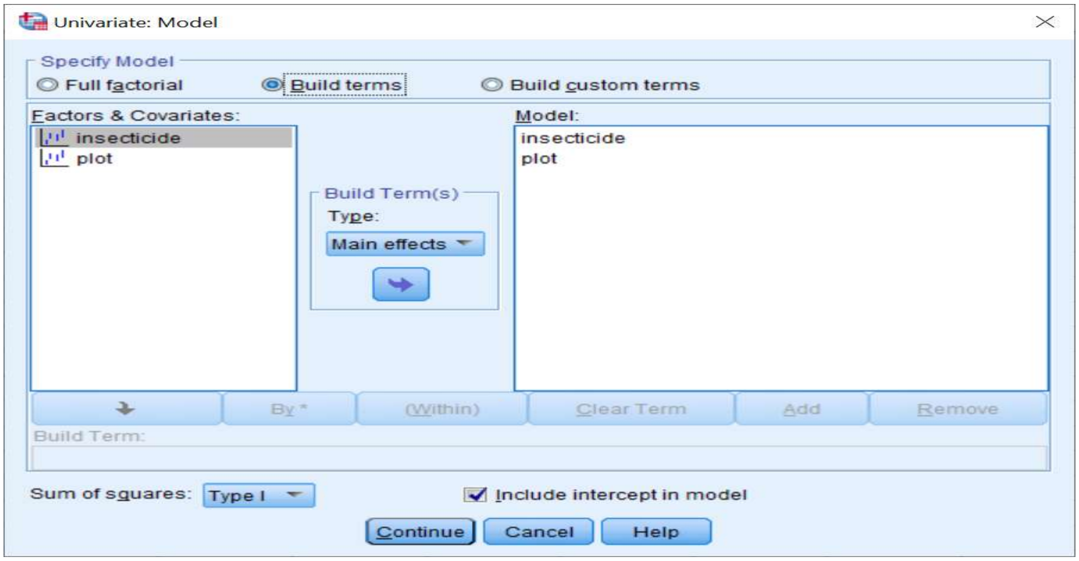
For the factor 2 (i.e. block) variable, we repeat: “Name” = plot, we have no need for decimals here since the plots are numbered 1,2,3,4. Next we click on “Values” and here we can label/code each plot as we wish.



To enter the data, we switch to **Data View** tab and start entering the values.

First, we enter our RBD model. To do so:

Select ‘**Analyze**’ → ‘**General Linear Model**’ → ‘**Univariate**’. Then select seedlings as ‘Dependent Variable’ and insecticide and plot as ‘Fixed Factors’. Since this is a one observation per treatment, we do not need interaction, therefore we click “**Model**” → ‘**Build terms**’ → select ‘**main effects**’ under Build terms in the middle and move both your factors into the Model box. Next select ‘include the model intercept’, if it is not selected.



Click "**Continue**". To obtain the ANOVA table for our RBD, click "**OK**".

Between-Subjects Factors

		Value Label	N
insecticide	1	insecticide 1	4
	2	insecticide 2	4
	3	insecticide 3	4
plot	1	plot 1	3
	2	plot 2	3
	3	plot 3	3
	4	plot 4	3

Tests of Between-Subjects Effects

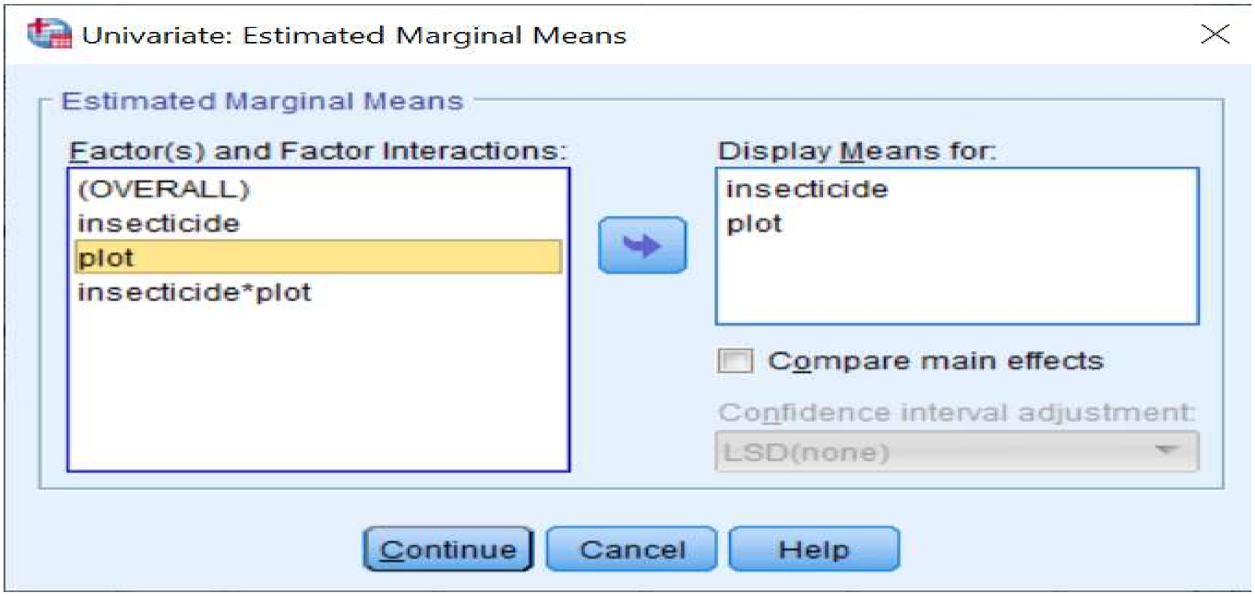
Dependent Variable: seedlings

Source	Type I Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2311.417[a]	5	462.283	118.030	.000
Intercept	67350.083	1	67350.083	17195.766	.000
insecticide	1925.167	2	962.583	245.766	.000
plot	386.250	3	128.750	32.872	.000
Error	23.500	6	3.917		
Total	69685.000	12			
Corrected Total	2334.917	11			

a. Squared = .990 (Adjusted R Squared = .982)

<u>NOTE:</u> Corrected Total = Total – Correction for the Mean = TSS

You can also have the means for each factor displayed. To do so, when in dialog box, click on "**EM Means**" and move variables for which you want the means to be displayed in to 'Display Means' box.



Estimated Marginal Means

1. insecticide

Dependent Variable: seedlings

insecticide	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
insecticide 1	57.500	.	.	.
insecticide 2	87.250	.	.	.
insecticide 3	80.000	.	.	.

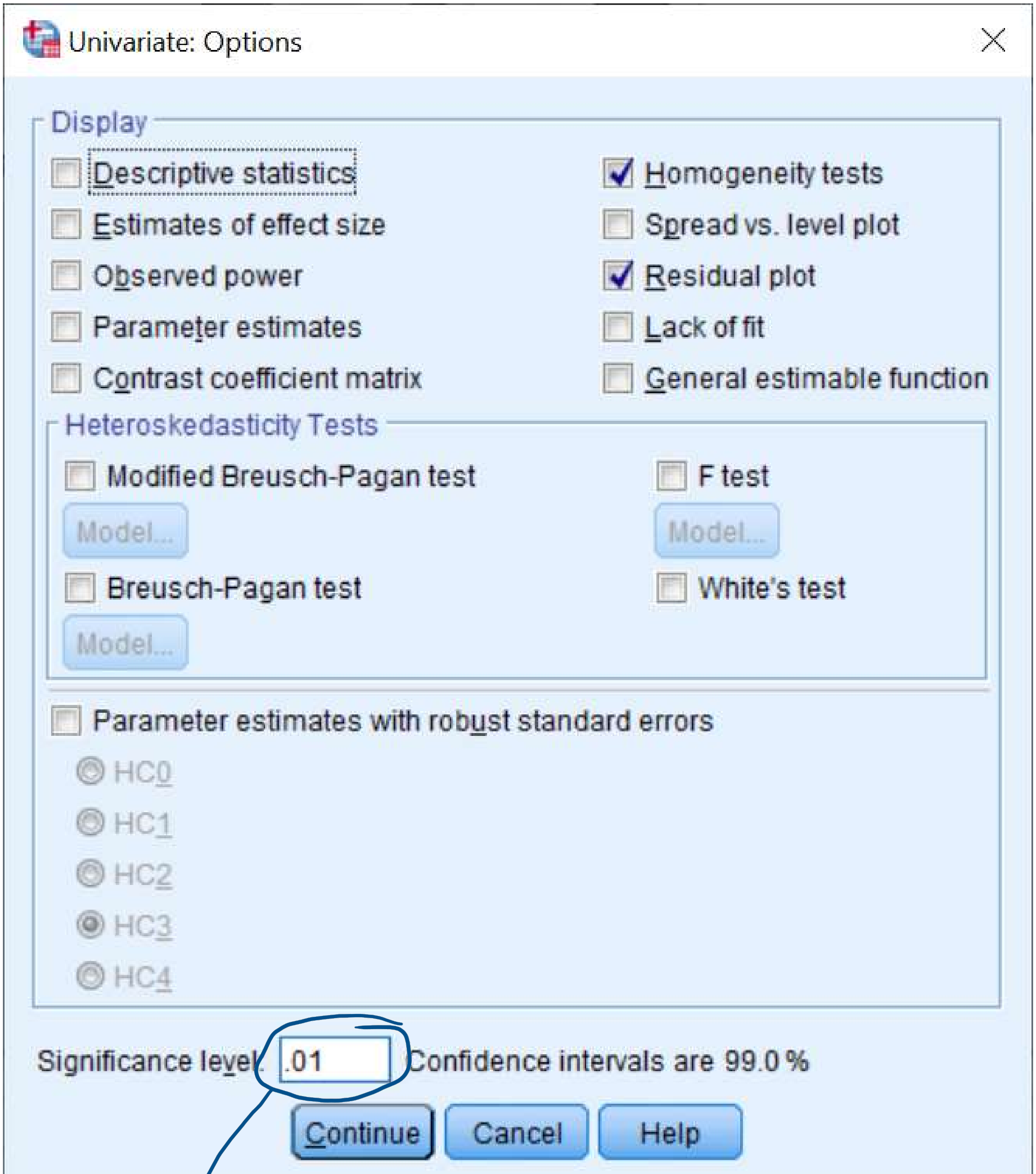
2. plot

Dependent Variable: seedlings

plot	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
plot 1	73.333	.	.	.
plot 2	66.333	.	.	.
plot 3	80.667	.	.	.
plot 4	79.333	.	.	.

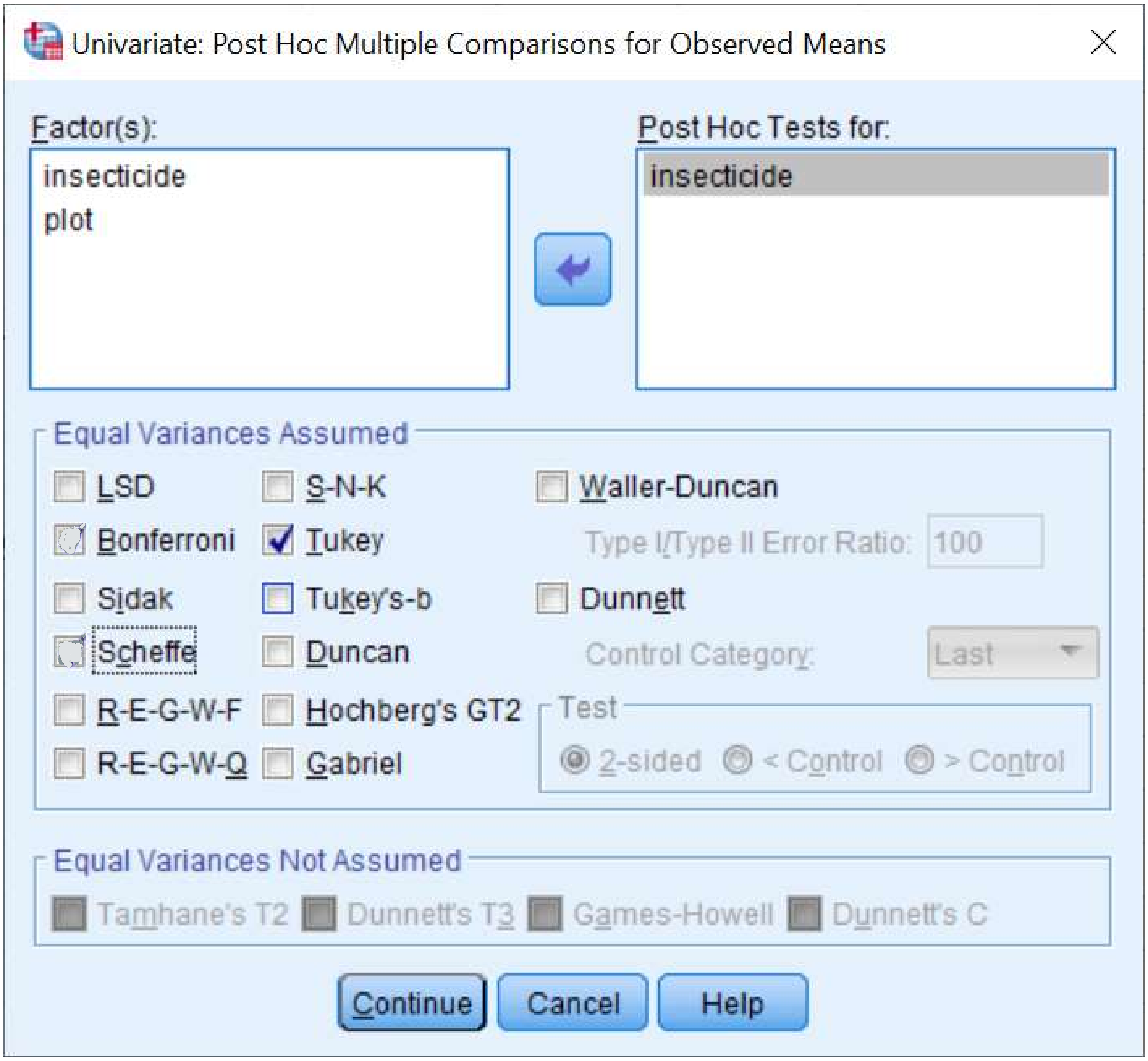
<u>Obtaining Simultaneous C.I.'s</u> (i.e. doing Multiple Comparisons) **<u>to compare treatment means</u>**:

Choose '**Analyze**' → '**General Linear Model**' → '**Univariate**'. Select seedlings as 'Dependent Variable" and insecticide and plot as 'Fixed Factors'. Then select "**Options**" and you can select what you wish to obtain e.g. if you want means and std. deviations, click on descriptive statistics. To get C.I.'s click on "**Post Hoc**"



if confidence level is ≠ 0.95 then indicate α here

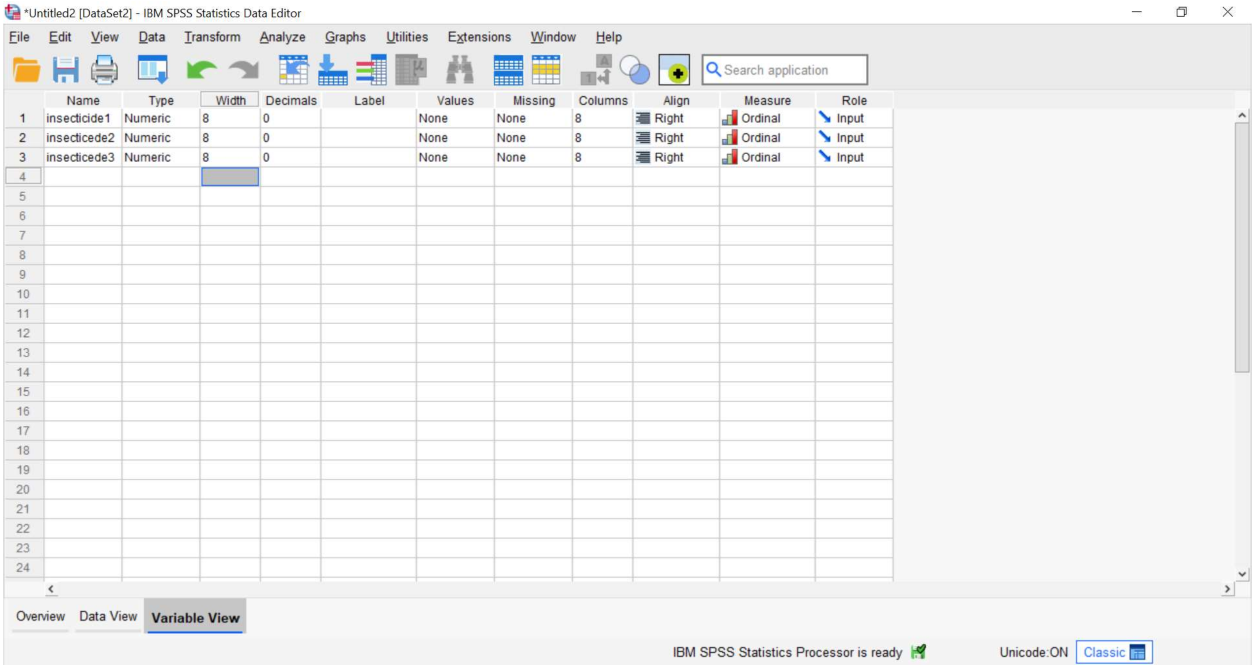
Note, that SPSS does not produce C.I.'s for factors with less than 3 levels.



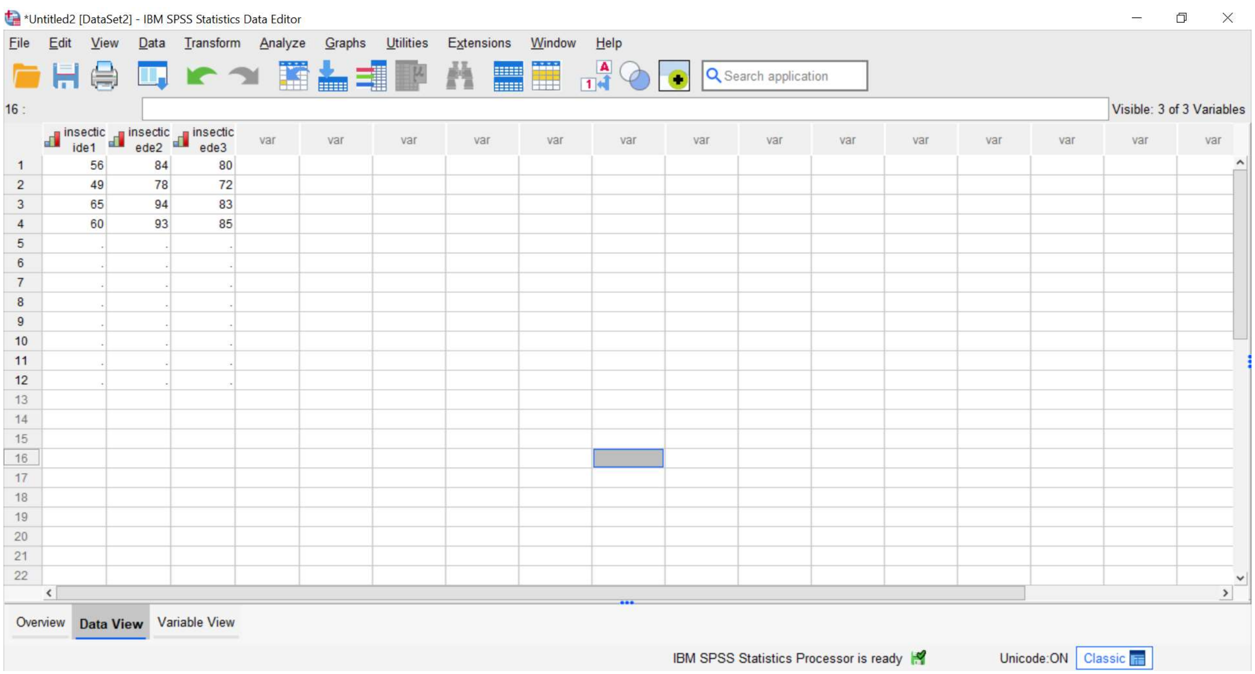
Here, you can choose the methods for Multiple Comparisons that you want to do and change the significance level if it is different than 5% (set by default). We did Tukey's hsd.

<u>Friedman-Rank Test</u>:

Since we are going to compare treatment medians, we need to create 3 new variables (one for each treatment):

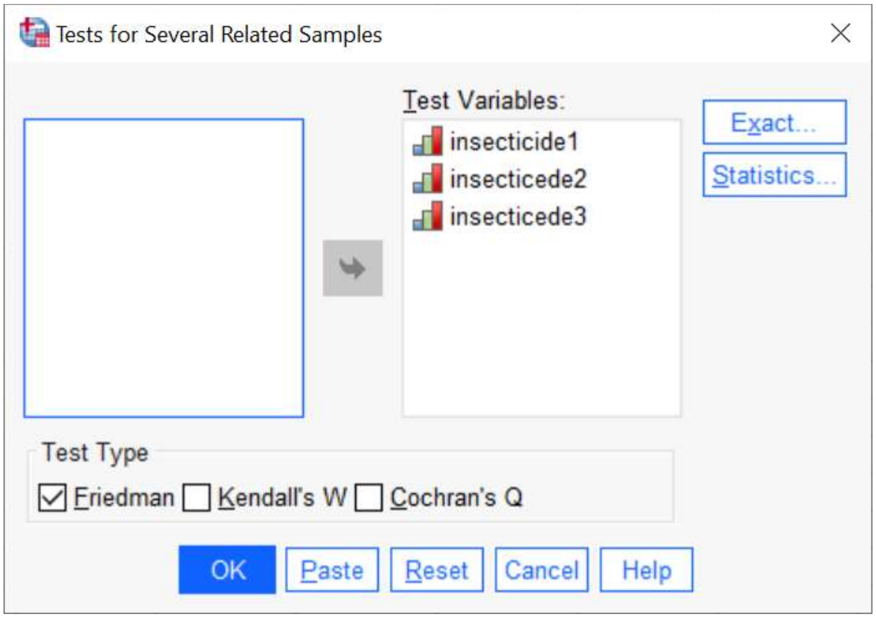


And in Data view:



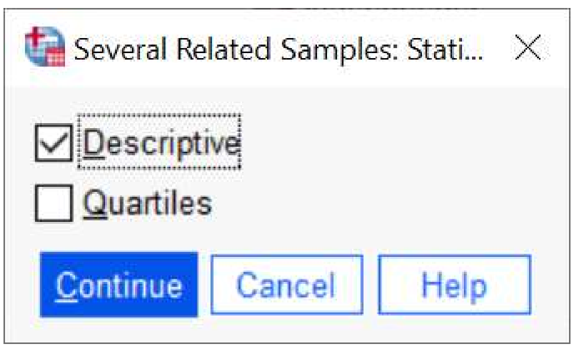
Select ‘**Analyze**’ → ‘**Nonparametric Test**’ → ‘**Legacy Dialogs**’ → ‘**K related Samples**’

Transfer the 3 insecticide variables to the Test Variables: box by using the  button or by dragging-and-dropping the variables into the box. You will end up with the following screen:



- Make sure that Friedman is selected in the –Test Type– area.

Click on "Statistics" and select "Descriptive" and then click on "Continue".



This will return you back to the **Tests for Several Related Samples** dialogue box. Click on "OK" to perform Friedman-Rank test.

The results are: **Friedman Test**

Ranks

	Mean Rank		
insecticide1	1.00	$\times 4$	$= T_{R_1}$
insecticede2	3.00	$\times 4$	$= T_{R_2}$
insecticede3	2.00	$\times 4$	$= T_{R_3}$

- here $N = 4$
so we need to multiply each "Mean Rank" by N to obtain rank totals

Test Statistics[a]

N	4
Chi-Square	8.000
df	2
Asymp. Sig.	.018

a. Friedman Test

← F_R approximation by χ^2