Monte Carlo studies

Contents

1. Introduction

The graphical user interface may be used to simulate data from uniform or normal distributions, or from mixtures of these distributions. To illustrate, suppose we want to simulate 50 observations on three variables, V1, V2, and V3. Suppose further that V1 has a normal distribution with a mean of 100 and standard deviation of 15; V2 = V1 + e2, where e2 has a normal distribution with mean zero and standard deviation of 15; and finally V3 = V1 + V2 + e3 where e3 has a uniform distribution with a mean of 10.

This may be accomplished by specifying

```
V1 = 100 + 15 * NRAND
V2 = V1 + 15 * NRAND
V3 = V1 + V2 + 20 * URAND,
```

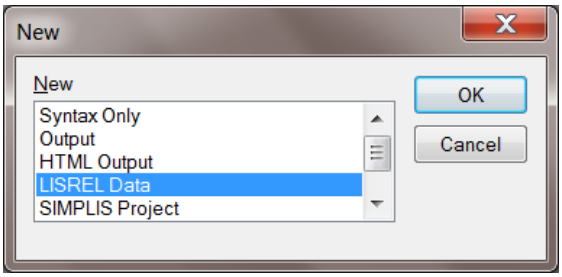
where NRAND has a normal (0;1) distribution and URAND a uniform (0;1) distribution.

The next sections illustrate

- The creation of a new LISREL system data file
- Insertion of variables into the LISREL system file
- Insertion of cases
- Simulation of data values
- Graphical displays

2. New LISREL (*.lsf) Data

From the **File** menu, select **New** to obtain the **New** dialog box. Select **LISREL Data** and click **OK** when done.



A new (but empty) LISREL system data file is displayed in the LSF window.

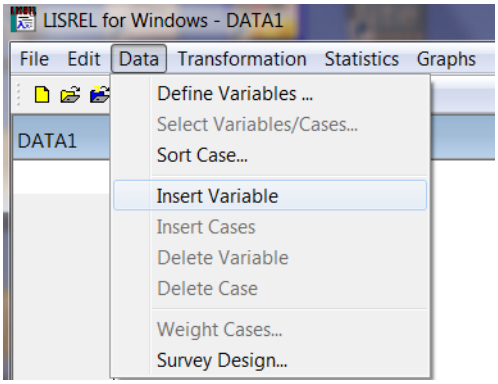
In order to simulate 50 observations of the form

V1 = 100 + 15 * NRAND,
V2 = V1 + 15 * NRAND, and
V3 = V1 + V2 + 20 * URAND,

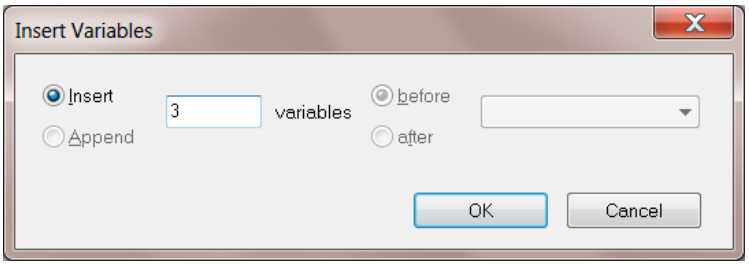
we need to create an empty data matrix with 3 columns and 50 rows, where each column represents a variable and each row an observation (case).

3. Inserting Variables into the Spreadsheet

We start by inserting the three variables V1 to V3. To do so, select the **Data**, **Insert Variables…** option.

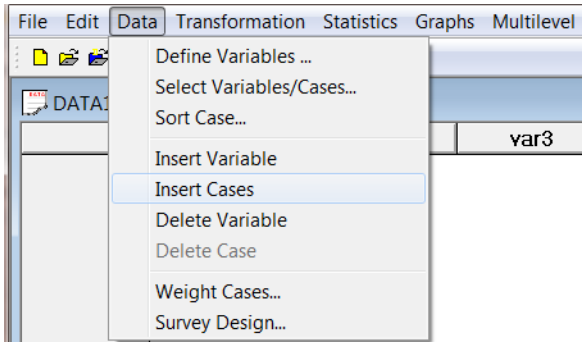


Use the **Insert Variables** dialog box to insert three variables and click **OK**.

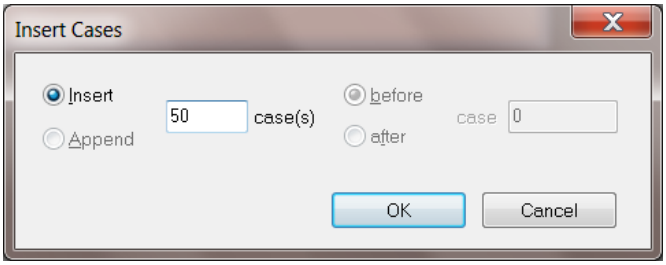


4. Inserting Cases into the Spreadsheet

The LISREL system file will now contain 3 columns headings corresponding to the variables var1-var3. Next, select the **Data**, **Insert Cases…** option, as shown next.

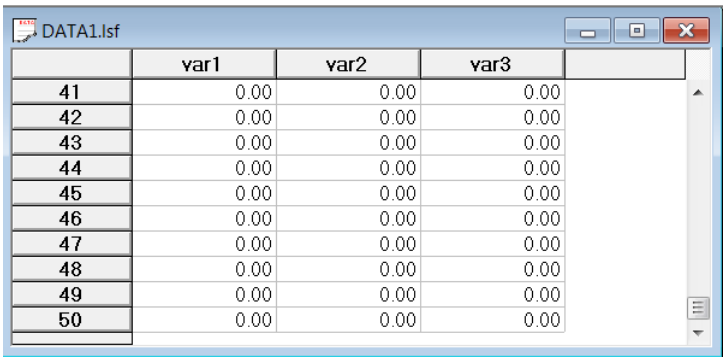


This action invokes the **Insert Cases** dialog. Enter the number of cases, that is, 50. Click **OK** to display the spreadsheet.



At this stage, this file should be saved as a ***.lsf**. This is accomplished by clicking the **File, Save as** option. Select a filename and folder, for example **data1.lsf**. Click **Save**.

The spreadsheet shown below now contains 50 cases.

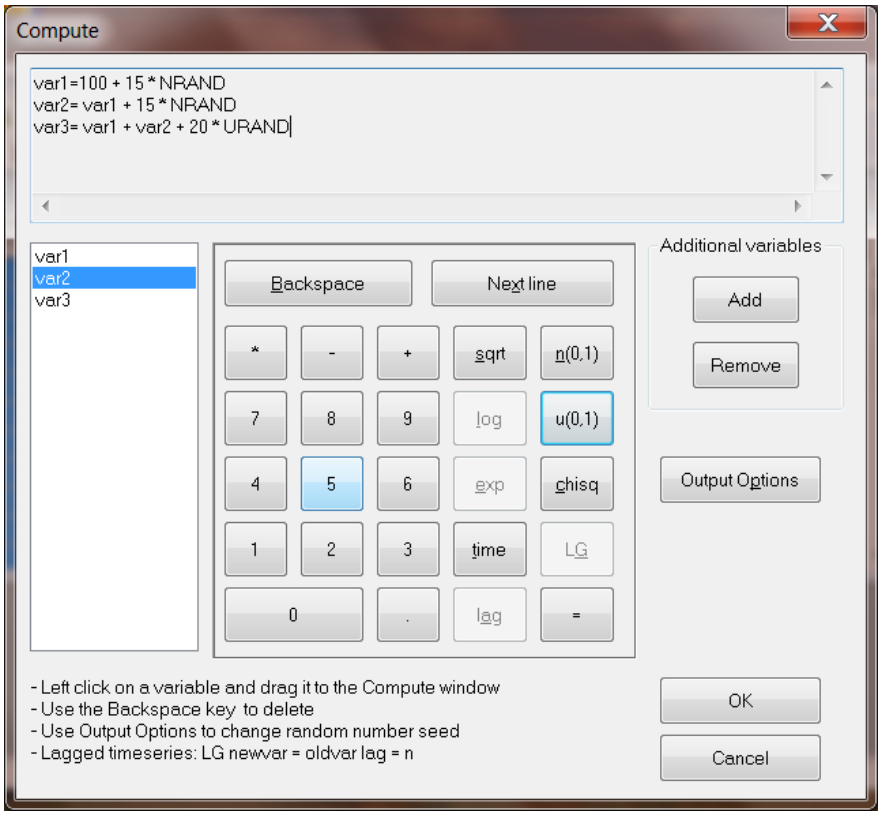


	var1	var2	var3
41	0.00	0.00	0.00
42	0.00	0.00	0.00
43	0.00	0.00	0.00
44	0.00	0.00	0.00
45	0.00	0.00	0.00
46	0.00	0.00	0.00
47	0.00	0.00	0.00
48	0.00	0.00	0.00
49	0.00	0.00	0.00
50	0.00	0.00	0.00

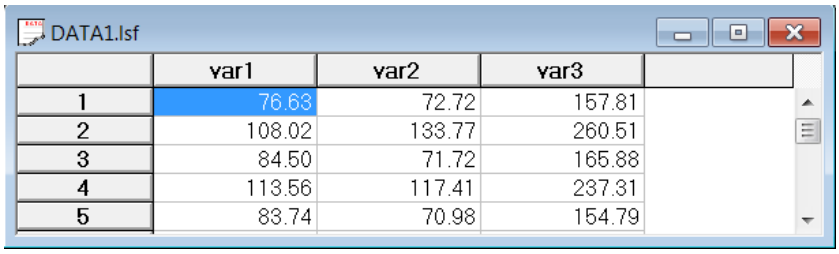
5. Simulating Data Values

From the **Transformation** menu, select the **Compute** option. This activates the **Compute** dialog box.

The three lines of syntax are entered as follows. Click on var1 and with the left mouse button held down, drag it to the position shown in the transformation window (or double click on the variable name). When done, click the "=" sign, then enter 100 + 15 * n(0,1)by clicking the corresponding buttons on the compute pad. To start the next syntax line, click on the **Next line** button. Proceed as described above until the 3 lines have been added. Note that the PRELIS symbols for n(0,1) and u(0,1) are NRAND and URAND respectively.



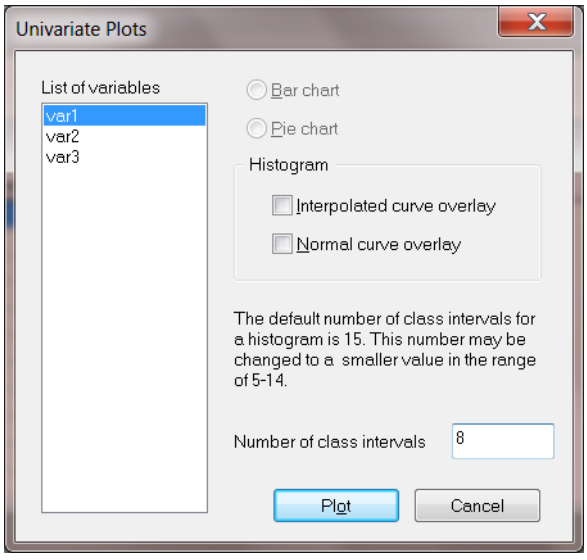
When done, click **Output Options** to obtain the **Output** dialog box. Select **Covariances** from the **Moment Matrix** drop-down list box. Check the **Save to file** check box directly below this and enter a filename, in this case **simul.cov**. Optionally, change the random seed number (in this case to 7613) to replicate the simulated dataset shown below. Click **OK** to return to the **Compute** dialog box and **OK** again when done.



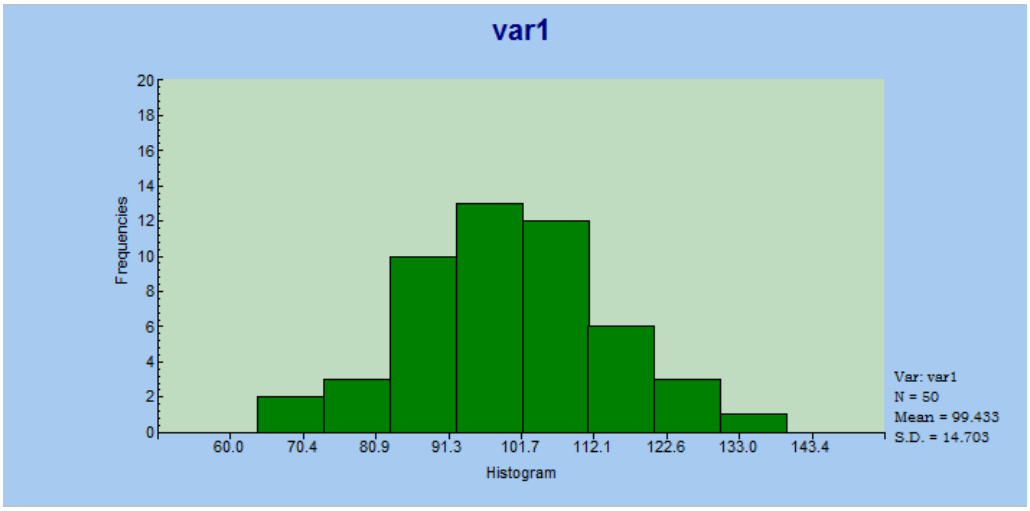
	var1	var2	var3
1	76.63	72.72	157.81
2	108.02	133.77	260.51
3	84.50	71.72	165.88
4	113.56	117.41	237.31
5	83.74	70.98	154.79

6. Graphical Displays

Use the **Data**, **Define** variables option to change the variable type of the three variables to continuous. Make sure to select the **File, Save** option to make these changes permanent. To obtain a histogram of the distribution of var1-values, click the var1 button if this column has been selected on the spreadsheet to de-select it then click the **Univariate Plot** icon button to produce the **Univariate Plots** dialog shown below.

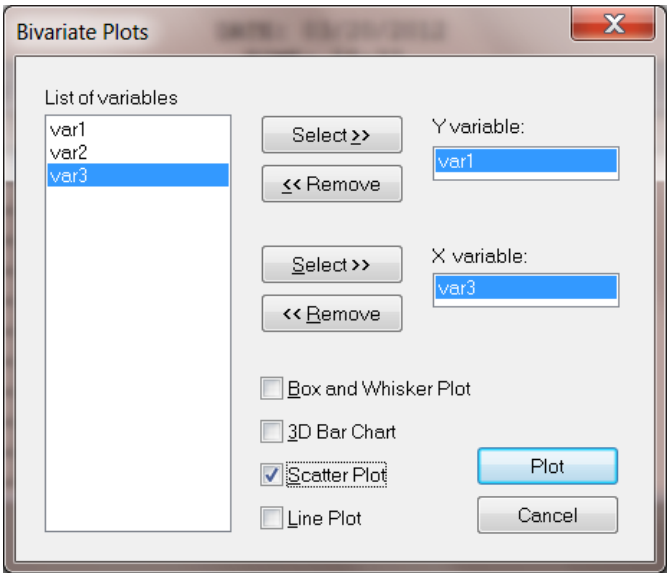


Change the number of class intervals to eight and click the **Plot** button to produce a histogram.

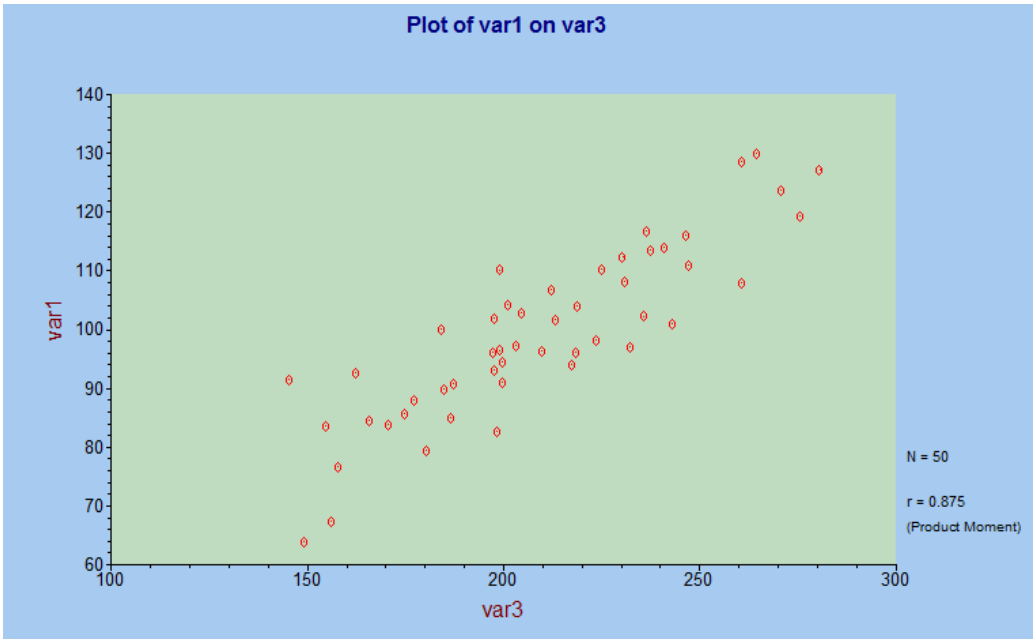


From the display, we see that the data follows a bell-shaped curve reasonably well. The sample mean and standard deviation values of 99.433 and 14.703 are close to the population values of 100 and 15 respectively, given the small sample size.

Finally, a bivariate plot of the distribution of var1 and var3 may be obtained by selecting **Bivariate** from the **Graphs** menu. In the **Bivariate Plot** dialog box, select var 1 as the Y-variable and var 3 as the X-variable. Also select **Scatter Plot** and click **Plot** when done.



The resulting bivariate display is shown below and it reveals a high (linear) correlation between var 1 and var 3.


Plot of var1 on var3
140
130
120
110
100
90
80
70
60
var1
100
150
200
250
300
var3
N = 50
r = 0.875
(Product Moment)