



Tests of univariate and multivariate normality

For each continuous variable, PRELIS gives test of zero skewness and zero kurtosis. For all continuous variables jointly, PRELIS gives tests of zero multivariate skewness and zero multivariate kurtosis. These tests have been developed by D'Agostina (1986), Mardia (1970, 1974, 1985), Mardia & Foster (1983) and are summarized in Bollen (1989, pp. 420 -5).

For an example of these tests of normality, we reconsider the test score data in Example 3A. The input file is **EX3A.PRL** (see the **PRELIS Examples** folder):

```
EXAMPLE 3A: TEST SCORE DATA
DA NI=11 NO=90
LA FI=LABELS.EX3
RA FI=DATA.EX3
CO ALL
OU MA=KM
```

The output file gives a histogram for each of the nine variables. It is obvious from these histograms that most of the variables are non-normal. This is confirmed by the statistic and tests of normality given in the output.

Univariate Summary Statistics for Continuous Variables

Variable	Mean	St. Dev.	Skewness	Kurtosis	Minimum Freq.	Maximum Freq.
V01	21.789	7.856	-1.117	0.333	0.000	2
V02	14.622	7.048	-0.173	-0.568	0.000	2
V07	11.489	3.069	-0.175	2.673	0.000	1
V08	14.478	3.660	-0.490	2.947	0.000	1
V09	19.122	6.830	-0.635	0.359	0.000	3
V10	21.622	5.560	-0.553	0.163	6.000	1
V21	15.022	2.998	-1.956	3.424	4.000	1
V22	13.122	3.304	-1.123	0.935	2.000	1
V23	12.578	3.402	-1.141	0.735	3.000	3
V24	8.611	3.550	-0.271	-0.551	0.000	1
V25	16.589	4.271	-1.338	2.425	1.000	1

Test of Univariate Normality for Continuous Variables

Variable	Skewness		Kurtosis		Skewness and Kurtosis	
	Z-Score	P-Value	Z-Score	P-Value	Chi-Square	P-Value
V01	-3.856	0.000	0.812	0.417	15.527	0.000
V02	-0.703	0.482	-1.376	0.169	2.388	0.303
V07	-0.709	0.478	3.068	0.002	9.913	0.007
V08	-1.914	0.056	3.222	0.001	14.048	0.001
V09	-2.423	0.015	0.855	0.392	6.601	0.037
V10	-2.141	0.032	0.515	0.607	4.848	0.089
V21	-5.651	0.000	3.465	0.001	43.935	0.000
V22	-3.873	0.000	1.644	0.100	17.701	0.000
V23	-3.920	0.000	1.400	0.162	17.329	0.000
V24	-1.090	0.275	-1.314	0.189	2.915	0.233
V25	-4.402	0.000	2.916	0.004	27.882	0.000

Relative Multivariate Kurtosis = 1.179

Test of Multivariate Normality for Continuous Variables

Value	Skewness		Value	Kurtosis		Skewness and Kurtosis	
	Z-Score	P-Value		Z-Score	P-Value	Chi-Square	P-Value
42.810	11.130	0.000	168.566	5.216	0.000	151.072	0.000

The tests of multivariate normality may be somewhat time consuming to compute. One can skip this computation by putting XM on the OU command.