



## Factor analysis of dichotomous variables

To factor analyze a set of dichotomous items to determine whether they can be used to represent an underlying unidimensional scale is a common problem in test theory. There are many methods and programs available for doing this. The following example demonstrates that it can also be done conveniently and efficiently with LISREL. The data used is the observed frequencies for 32 response patterns arising from five dichotomous items of Section 6 of the LSAT. The sample is a subsample of 1000 from a larger sample of those who took the test.

First we use the following PRELIS command file (**EX73.PRL**) to produce the tetrachoric correlations and their asymptotic variances and covariances.

```
LSAT SECTION 6
This example computes the full asymptotic covariance matrix of
tetrachoric correlations which can be used with WLS in LISREL.
See pp. 230-232 of Joreskog and Sorbom (1989): "LISREL : User's
Reference Guide." Chicago: Scientific Software
DA NI=6 NO=1000
RA FI=LSAT6.DAT
WE 6
OR ALL
OU MA=PM SM=EX73.PML SA=EX73.ACP
```

This produces the asymptotic covariance matrix in the file **EX73.ACP** and the following matrix of tetrachoric correlations:

### Estimated Correlation Matrix

	VAR 1	VAR 2	VAR 3	VAR 4	VAR 5
VAR 1	1.000				
VAR 2	0.170	1.000			
VAR 3	0.228	0.189	1.000		
VAR 4	0.107	0.111	0.187	1.000	
VAR 5	0.067	0.172	0.105	0.201	1.000

We can now analyze the data with LISREL using the following command file (**EX73.LIS**):

```
FACTOR ANALYSIS OF DICHOTOMOUS VARIABLES: LSAT6 DATA
DA NI=5 NO=1000 MA=PM
PM FI=EX73.PML
AC FI=EX73.ACP
MO NX=5 NK=1 LX=FR PH=ST
OU SE TV RS ME=WLS
```

The resulting output file shows the following solution, standard errors, and standardized residuals, indicating that the five items may well fit a unidimensional scale. The only item which is a little bit odd is item 5.

LISREL Estimates (Weighted Least Squares)

```
LAMBDA-X
      KSI 1
-----
VAR 1   0.385
      (0.110)
      3.484

VAR 2   0.414
      (0.082)
      5.050

VAR 3   0.454
      (0.082)
      5.506

VAR 4   0.388
      (0.083)
      4.674

VAR 5   0.355
      (0.092)
      3.863
```

```
PHI
      KSI 1
-----
      1.000
```

THETA-DELTA

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5
0.852	0.829	0.794	0.850	0.874
(0.091)	(0.075)	(0.081)	(0.072)	(0.073)
9.406	11.062	9.787	11.855	12.045

Squared Multiple Correlations for X - Variables

VAR 1	VAR 2	VAR 3	VAR 4	VAR 5
0.148	0.171	0.206	0.150	0.126

Goodness-of-Fit Statistics

Degrees of Freedom 5  
 Weighted Least Squares Chi-Square (C1) 5.0794 (P = 0.4063)

Standardized Residuals

	VAR 1	VAR 2	VAR 3	VAR 4	VAR 5
VAR 1	- -				
VAR 2	0.226	- -			
VAR 3	1.179	0.050	- -		
VAR 4	-0.727	-1.331	0.408	- -	
VAR 5	-0.944	0.585	-1.365	1.359	- -

Summary Statistics for Standardized Residuals

Smallest Standardized Residual = -1.365  
 Median Standardized Residual = 0.000  
 Largest Standardized Residual = 1.359