Two stage multiple imputation SEM using student data

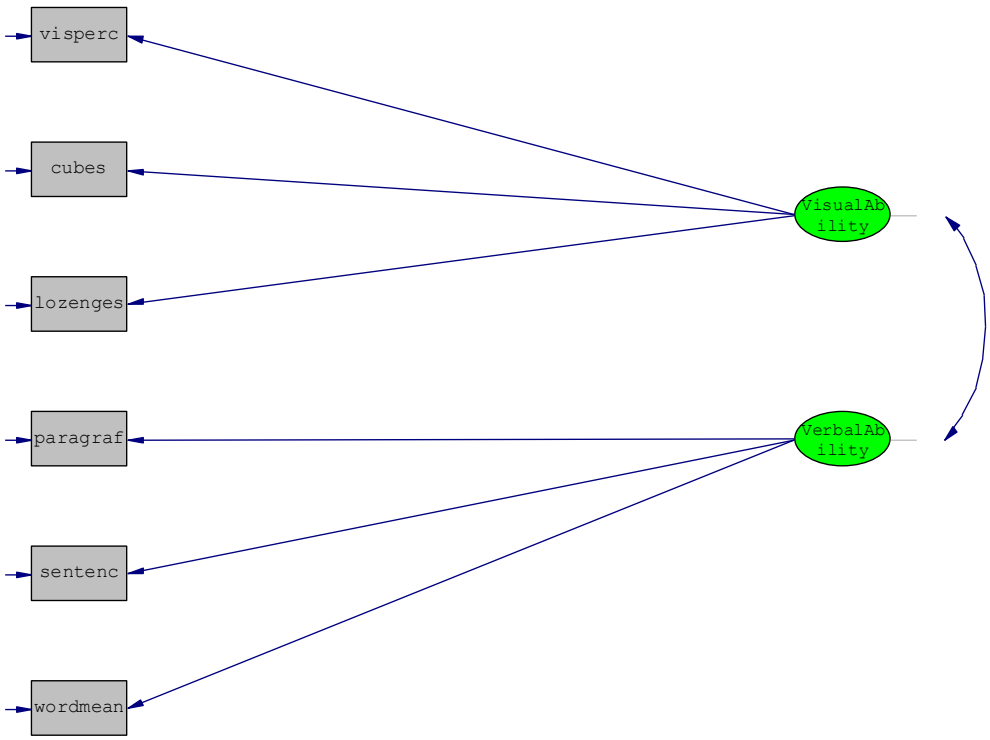
The data are the simulated scores of 2500 students on six psychological tests (visual perception, cubes, lozenges, paragraph completion, sentence completion, and word meaning) along with the gender of the students. The corresponding data file is **GENDER.LSF**, and the first few observations are shown below.

GENDER.LSF

	visperc	cubes	lozenges	Gender	paragraf	sentenc	wordmean
1	-0.72	-1.95	-7.69	1.00	-9.00	-9.00	6.71
2	-6.45	-8.07	-2.52	1.00	0.54	1.25	9.17
3	8.83	-3.73	11.51	1.00	2.46	2.89	9.31
4	-9.00	-4.13	16.95	1.00	1.23	4.65	8.29
5	-9.00	1.08	-9.41	1.00	-9.00	-6.49	-11.79
6	-10.63	-9.00	0.32	1.00	0.58	5.88	-9.00
7	-9.00	6.41	-9.00	1.00	-9.00	-0.04	-9.00
8	-9.00	-1.64	7.20	1.00	-0.43	2.98	4.68
9	2.61	5.62	-2.34	1.00	-0.26	-1.39	-9.00
10	0.73	-8.51	-6.62	1.00	-9.00	-9.00	-24.84
11	-3.68	-3.84	5.57	1.00	5.55	7.62	10.74
12	-6.29	1.97	-17.09	1.00	3.20	-0.97	8.66
13	6.57	-9.00	-11.94	1.00	-9.00	-9.00	-2.80
14	8.81	-5.28	-9.00	1.00	-2.74	0.14	-9.00
15	-2.62	-9.00	3.51	1.00	-0.24	-4.57	-9.00

Note that the data values of -9.00 are missing data values. If a different global missing data value code is used, it should be assigned using the **Define Variables** dialog box.

The theoretical model is a measurement model that specifies that the six psychological tests are indicators of visual ability and verbal ability of Junior High students. A path diagram for this model is depicted in the image below.



The SIMPLIS syntax file to assess the configural invariance of the theoretical model above for gender is shown in the image below.

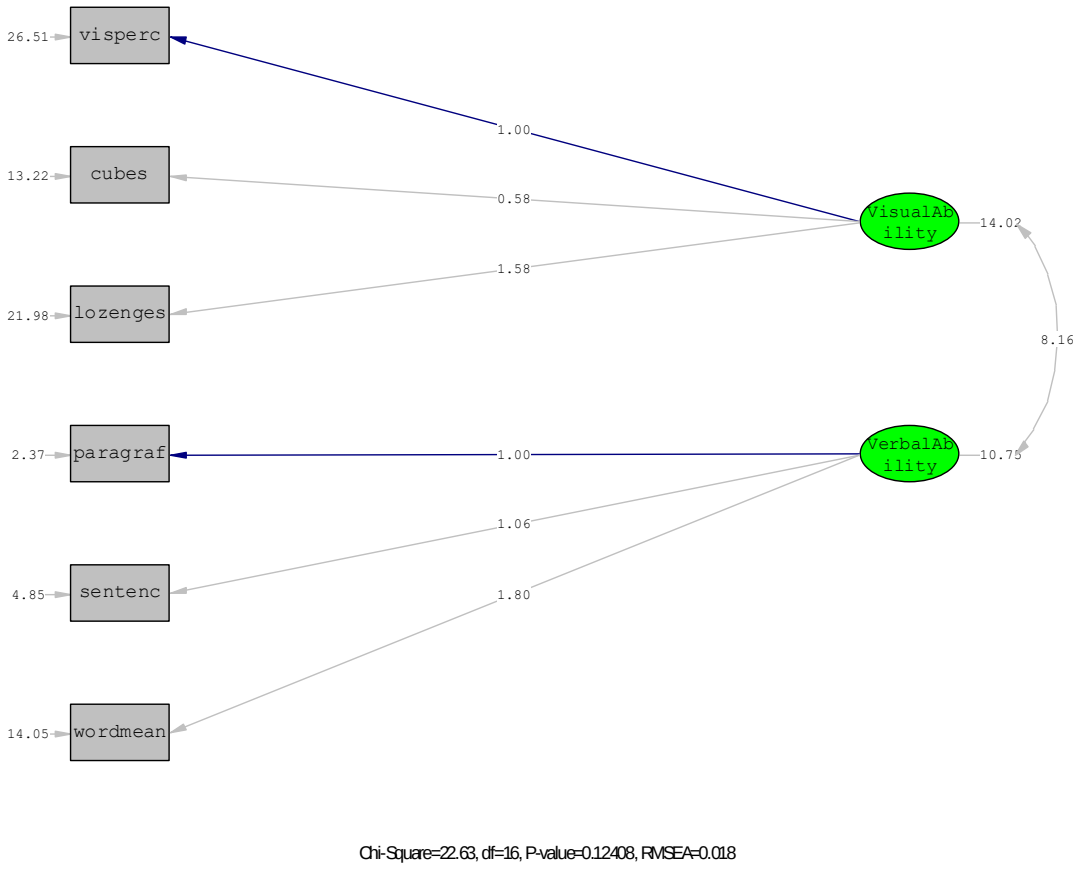
GENDER4A.SPL

```
$GROUPS = Gender
Raw data from file GENDER.LSF
Latent Variables: VisualAbility VerbalAbility
Relationships
visperc = 1.00*VisualAbility
cubes lozenges = VisualAbility
paragraf = 1.00*VerbalAbility
sentenc wordmean = VerbalAbility
Group Girls
Raw data from file GENDER.LSF
Latent Variables: VisualAbility VerbalAbility
Relationships
cubes lozenges = VisualAbility
sentenc wordmean = VerbalAbility
Set the Variance of VisualAbility Free
Set the Covariance of VerbalAbility and VisualAbility Free
Set the Variance of VerbalAbility Free
Set the Error Variance of visperc-lozenges Free
Set the Error Variance of paragraf-wordmean Free
LISREL Output: MI2S ME=ML IM=MC NM=10 IX=5917
Path Diagram
End of Problem
```

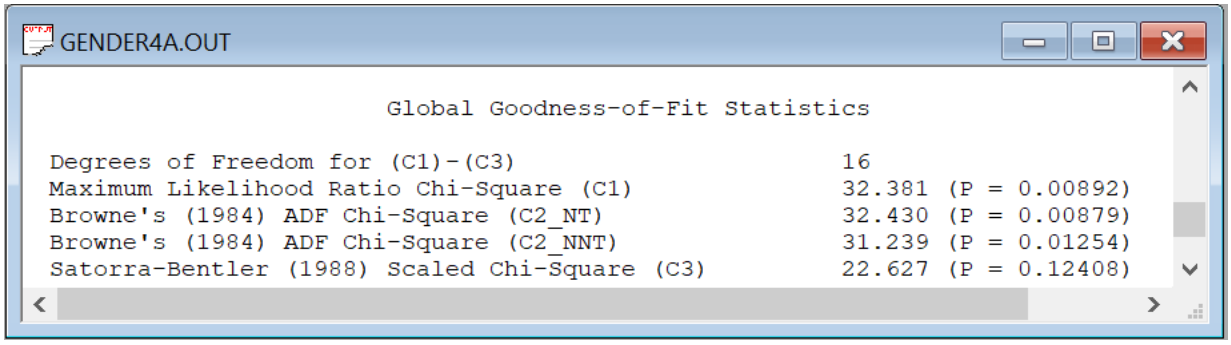
- Line 1 specifies the label for the first group.
- Line 2 specifies the grouping variable.
- Line 3 specifies the data file.
- Line 4 specifies the labels for the latent variables of the model.
- Lines 5 to 9 specify the theoretical model for the first group.
- Line 10 specifies the label for the second group.
- Line 11 specifies the data file.
- Line 12 specifies the labels for the latent variables of the model.
- Lines 13 to 20 specify the theoretical model for group 2.

- Line 21 requests that the results in the output file should be given in terms of the LISREL model for the measurement model (LISREL Output). The MI2S option invokes the two-stage multiple imputation SEM method to fit the model to the average sample mean vectors and the average sample covariance matrices of the NM = 10 MCMC imputations (IM = MC) for the two groups based on an initial random seed of IX = 5917 using robust maximum likelihood estimation (ME = ML).
- Line 22 requests a path diagram of the model.
- Line 23 indicates that no more SIMPLIS commands are to be processed.

If this SPL file is opened in LISREL and the **Run LISREL** icon is clicked, the following path diagram is obtained.



The corresponding output file, **GENDER4A.OUT**, is opened in a separate window. The Chi-square test statistic values, which are listed in this file, are shown in the image below.



The Satorra-Bentler scaled Chi-square value (C3) indicate that the configural invariance of the measurement model for gender is supported by the data.