Package 'SEMModComp'

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Description Conduct tests of difference in fit for mean and covariance structure models as in structural equation modeling (SEM)

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LazyLoad yes

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`SEMModComp-package` *Conduct tests of difference in fit for mean and covariance structure models as in structural equation modeling (SEM)*

Description

Chi-squared and normal theory likelihood ratio tests for mean and covariance structure models as in structural equation modeling (SEM). Used to statistically compare models in accordance with the framework described by Levy and Hancock (2007).

Details

Package:	SEMModComp
Type:	Package
Version:	1.0
Date:	2009-02-16
License:	GPL (version 3 or later)
LazyLoad:	yes

Author(s)

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References

Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36. Further documentation available at http://www.public.asu.edu/~rlevy2/papers&software.html

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`ChiSquaredLRTest` *Conduct Chi-Squared Likelihood Ratio Test for Mean and Covariance Structure Models*

Description

ChiSquaredLRTest performs the chi-squared likelihood ratio test for comparing hierarchically related mean and covariance structure models. Computations follow those in Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

Usage

```
ChiSquaredLRTest(x, model.1.mean.vector, model.1.cov.matrix,
 model.1.df, model.2.mean.vector,
 model.2.cov.matrix, model.2.df)
```

Arguments

x	The raw data arranged with subjects as rows and measured variables as columns.
model.1.mean.vector	The model-implied mean vector from model 1, the more restricted (nested) model. If no value is supplied, will employ the mean vector from the sample.
model.1.cov.matrix	The model-implied covariance matrix from model 1, the more restricted (nested) model. If no value is supplied, will employ the covariance matrix from the sample.
model.1.df	The degrees of freedom for model 1, the more restricted (nested) model. If no value is supplied, will set equal to 0.
model.2.mean.vector	The model-implied mean vector from model 2, the more general model. If no value is supplied, will employ the mean vector from the sample.
model.2.cov.matrix	The model-implied covariance matrix from model 2, the more general model. If no value is supplied, will employ the covariance matrix from the sample.
model.2.df	The degrees of freedom for model 2, the more general model. If no value is supplied, will set equal to 0.

Details

The test is used to test for distinguishability and difference in fit between two models that are hierarchically related (i.e., nested) via referring -2* the likelihood ratio to a central chi-squared distribution with degrees of freedom equal to the difference in degrees of freedom for the two models. The test may also be used to conduct the chi-squared test of model fit for an individual model by not employing arguments for model 2. The test is also used (twice) to test for distinguishability in partially overlapping models See Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36. The function will perform listwise deletion in order to analyze a data set with no missing data. If the mean vector(s) and/or covariance matrix(ces) are not supplied for the models, the program will employ the estimates from the sample. If the number of degrees of freedom is not supplied for a model the program will employ a value of 0.

Value

a list containing:

N	Total number of subjects in the data set
N.complete.data	Number of subjects with complete data used in the analysis
LR	The value of the likelihood ratio statistic
chi.sq.stat	The test statistic. Under the null hypothesis of no difference in fit
df.test	The degrees of freedom of the test, evaluated as (model.1.df-model.2.df)
p	The p-value for the observed test statistic

Author(s)

Roy Levy <Roy.Levy@asu.edu>

References

Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

Examples

```
  # Load the data, model-implied moments, and degrees of freedom for the
  # comparison of Model A to Model C (the BFPD-C) in Levy and Hancock (2007)
  data(cigandalc.dat)
  data(model.A.mean.vector)
  data(model.A.cov.matrix)
  data(model.A.df)
  data(model.C.mean.vector)
  data(model.C.cov.matrix)
  data(model.C.df)

  # Conduct the chi-squared difference LR test for the comparison of Model A
  # to Model C (the BFPD-C) in Levy and Hancock (2007)
  LR.model.A.to.model.C  <- ChiSquaredLRTest(
x = cigandalc.dat,
model.1.mean.vector = model.C.mean.vector,
model.1.cov.matrix = model.C.cov.matrix,
model.1.df = model.C.df,
model.2.mean.vector = model.A.mean.vector,
model.2.cov.matrix = model.A.cov.matrix,
model.2.df = model.A.df
  )

  # Conduct the chi-squared LR test for Model A in Levy and Hancock (2007)
  # Illustrates the use of the function to evaluate a single model
  # (equivalently, in comparison to a saturated model)
  LR.model.A  <- ChiSquaredLRTest(
x = cigandalc.dat,
model.1.mean.vector = model.A.mean.vector,
```

```
model.1.cov.matrix = model.A.cov.matrix,
model.1.df = model.A.df
  )
```

`cigandalc.dat` *Raw data on cigarette and alcohol use*

Description

Values from 1204 subjects on 8 variables related to cigarette and alcohol use

Usage

```
data(cigandalc.dat)
```

Format

A data frame with 1204 observations on 8 variables.

Source

Bentler, P. M. (2004). EQS 6 structural equations program manual. Encino, CA: Multivariate Software.

References

Data originally collected by Duncan, T. E., Duncan, S. C., Alpert, A., Hops, H., Stoolmiller, M., & Muthén, B. (1997). Latent variable modeling of longitudinal and multilevel substance use data. Multivariate Behavioral Research, 32, 275-318. For its use in the illustration see also Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

`model.A.cov.matrix` *Model A's model-implied covariance matrix*

Description

An 8x8 matrix: the model-implied covariance matrix from Model A in the illustration in Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

Usage

```
data(model.A.cov.matrix)
```

Source

Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

References

Data and models based off of original data collection and model formulation by Duncan, T. E., Duncan, S. C., Alpert, A., Hops, H., Stoolmiller, M., & Muthén, B. (1997). Latent variable modeling of longitudinal and multilevel substance use data. Multivariate Behavioral Research, 32, 275-318.

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model.A.df *Model A's degrees of freedom*

Description

The number 25, the degrees of freedom for Model A in the illustration in Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

Usage

```
data(model.A.df)
```

Source

Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

References

Data and models based off of original data collection and model formulation by Duncan, T. E., Duncan, S. C., Alpert, A., Hops, H., Stoolmiller, M., & Muthén, B. (1997). Latent variable modeling of longitudinal and multilevel substance use data. Multivariate Behavioral Research, 32, 275-318.

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model.A.mean.vector *Model A's model-implied mean vector*

Description

A vector of 8 numbers: the model-implied mean vector from Model A in the illustration in Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

Usage

```
data(model.A.mean.vector)
```

Source

Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

References

Data and models based off of original data collection and model formulation by Duncan, T. E., Duncan, S. C., Alpert, A., Hops, H., Stoolmiller, M., & Muthén, B. (1997). Latent variable modeling of longitudinal and multilevel substance use data. Multivariate Behavioral Research, 32, 275-318.

---

model.B.cov.matrix *Model B's model-implied covariance matrix*

Description

An 8x8 matrix: the model-implied covariance matrix from Model B in the illustration in Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

Usage

```
data(model.B.cov.matrix)
```

Source

Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

References

Data and models based off of original data collection and model formulation by Duncan, T. E., Duncan, S. C., Alpert, A., Hops, H., Stoolmiller, M., & Muthén, B. (1997). Latent variable modeling of longitudinal and multilevel substance use data. Multivariate Behavioral Research, 32, 275-318.

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model.B.df *Model B's degrees of freedom*

Description

The number 25, the degrees of freedom for Model B in the illustration in Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

Usage

```
data(model.B.df)
```

Source

Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

References

Data and models based off of original data collection and model formulation by Duncan, T. E., Duncan, S. C., Alpert, A., Hops, H., Stoolmiller, M., & Muthén, B. (1997). Latent variable modeling of longitudinal and multilevel substance use data. Multivariate Behavioral Research, 32, 275-318.

---

model.B.mean.vector *Model B's model-implied mean vector*

Description

A vector of 8 numbers: the model-implied mean vector from Model B in the illustration in Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

Usage

```
data(model.B.mean.vector)
```

Source

Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

References

Data and models based off of original data collection and model formulation by Duncan, T. E., Duncan, S. C., Alpert, A., Hops, H., Stoolmiller, M., & Muthén, B. (1997). Latent variable modeling of longitudinal and multilevel substance use data. Multivariate Behavioral Research, 32, 275-318.

---

model.C.cov.matrix *Model C's model-implied covariance matrix*

Description

An 8x8 matrix: the model-implied covariance matrix from Model C (the BFPD-C) in the illustration in Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

Usage

```
data(model.C.cov.matrix)
```

Source

Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

References

Data and models based off of original data collection and model formulation by Duncan, T. E., Duncan, S. C., Alpert, A., Hops, H., Stoolmiller, M., & Muthén, B. (1997). Latent variable modeling of longitudinal and multilevel substance use data. Multivariate Behavioral Research, 32, 275-318.

`model.C.df` *Model C's degrees of freedom*

Description

The number 26, the degrees of freedom for Model C (the BFPD-C) in the illustration in Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

Usage

```
data(model.C.df)
```

Source

Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

References

Data and models based off of original data collection and model formulation by Duncan, T. E., Duncan, S. C., Alpert, A., Hops, H., Stoolmiller, M., & Muthén, B. (1997). Latent variable modeling of longitudinal and multilevel substance use data. Multivariate Behavioral Research, 32, 275-318.

`model.C.mean.vector` *Model C's model-implied mean vector*

Description

A vector of 8 numbers: the model-implied mean vector from Model C (the BFPD-C) in the illustration in Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

Usage

```
data(model.C.mean.vector)
```

Source

Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

References

Data and models based off of original data collection and model formulation by Duncan, T. E., Duncan, S. C., Alpert, A., Hops, H., Stoolmiller, M., & Muthén, B. (1997). Latent variable modeling of longitudinal and multilevel substance use data. Multivariate Behavioral Research, 32, 275-318.

`NormalTheoryLRTest` *Conduct Normal Theory Likelihood Ratio Test for Mean and Covariance Structure Models*

Description

`NormalTheoryLRTest` performs the normal theory likelihood ratio test for comparing distinguishable mean and covariance structure models. See Equations 19, 7, and 10 of Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

Usage

```
NormalTheoryLRTest(x, model.1.mean.vector, model.1.cov.matrix,
   model.2.mean.vector, model.2.cov.matrix)
```

Arguments

`x` The raw data arranged with subjects as rows and measured variables as columns.

`model.1.mean.vector`
The model-implied mean vector from model 1. If no value is supplied, will employ the mean vector from the sample.

`model.1.cov.matrix`
The model-implied covariance matrix from model 1. If no value is supplied, will employ the covariance matrix from the sample.

`model.2.mean.vector`
The model-implied mean vector from model 2. If no value is supplied, will employ the mean vector from the sample.

`model.2.cov.matrix`
The model-implied covariance matrix from model 2. If no value is supplied, will employ the covariance matrix from the sample.

Details

The test is used to test for difference in fit between two models that are (a) partially overlapping and distinguishable with unique best fitting probability distributions (BFPDs), or (b) completely nonoverlapping (and therefore distinguishable with unique BFPDs). See Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36;

especially equations 19, 7, and 10. The function will perform listwise deletion in order to analyze a data set with no missing data. If the mean vector(s) and/or covariance matrix(ces) are not supplied for the models, the program will employ the estimates from the sample.

Value

a list containing:

`N`	Total number of subjects in the data set
`N.complete.data`	Number of subjects with complete data used in the analysis
`LR`	The value of the likelihood ratio statistic
`Omega.hat`	The estimated standard deviation involved in the T statistic
`T`	The test statistic. Under the null hypothesis of no difference in fit, T is asymptotically ~ N(O,1)
`p`	The 2-tailed p-value for the observed test statistic T

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References

Levy, R., & Hancock, G. R. (2007). A framework of statistical tests for comparing mean and covariance structure models. Multivariate Behavioral Research, 42, 33-36.

Examples

```
  # Load the data and model-implied moments for the comparison of Model A
  # to Model B in Levy and Hancock (2007)
  data(cigandalc.dat)
  data(model.A.mean.vector)
  data(model.A.cov.matrix)
  data(model.B.mean.vector)
  data(model.B.cov.matrix)

  # Conduct the normal theory LR test for the comparison of Model A
  # to Model B in Levy and Hancock (2007)
  LR.model.A.to.model.B <- NormalTheoryLRTest(
x = cigandalc.dat,
model.1.mean.vector = model.A.mean.vector,
```

```
model.1.cov.matrix = model.A.cov.matrix,
model.2.mean.vector = model.B.mean.vector,
model.2.cov.matrix = model.B.cov.matrix
  )
```

`ReadSymMatrixFromTriangle` *Read in a symmetric matrix from a data file containing the triangle of the matrix and the main diagonal*

Description

Produces a symmetric matrix (e.g., a covariance matrix) from a file that contains the triangle of the matrix and the main diagonal. Structural equation modeling (SEM) programs often report model-implied covariance matrices by reporting the lower triangle (containing covariances) and the diagonal (containing variances).

Usage

```
ReadSymMatrixFromTriangle(file, n.vars)
```

Arguments

`file`	Path to data file containing the triangle and main diagonal of the matrix
`n.vars`	The number of number of rows and columns in the matrix (i.e., the number of variables)

Value

A symmetric matrix with n.vars rows and n.vars columns

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