MACE model

Model description

This is a MACE example as described in Schaeffer: Multiple-country comparison of dairy sires (J. Dairy Sci., 77(9):2671–2678, 1994). It is multiple trait sire model where yields of daughters in different countries are considered as different traits.

The model is:

$$\mathbf{y} = \mathbf{X\mu} + \mathbf{Zs} + \mathbf{e},$$

where

$\mathbf{y}$ is vector of bulls daughter yield deviations in different countries,
$\boldsymbol{\mu}$ is genetic base by countries,
$\mathbf{s}$ is vector of random sire transmitting ability effects by countries, and
$\mathbf{e}$ is random residual vector.

It is assumed that $\mathrm{var}(\mathbf{s}) = \mathbf{A}\otimes\mathbf{G}_0 = \mathbf{G}$, $\mathrm{var}(\mathbf{e}) = \mathbf{I}\otimes\mathbf{R}_\mathrm{i} = \mathbf{R}$ and $\mathrm{cov}(\mathbf{s},\mathbf{e}) = \mathrm{cov}(\mathbf{e},\mathbf{s}) = \mathbf{0}$, where $\mathbf{G}_0$ has variance and covariance components for random sire effects, $\mathbf{R}_\mathrm{i}$ varies by sire and $\mathbf{A}$ is the numerator relationship matrix.

Variance-covariance matrices are

$$\mathbf{G}_0 = \begin{bmatrix} 100.0 & 20.0 \\ 20.0 & 5.0 \end{bmatrix}$$

and

$$\mathbf{R}_i = \begin{bmatrix} 1000.0 & 0 \\ 0 & 80.0 \end{bmatrix} \cdot w_i$$

Input files

Datafile:

The data file contains information on the data to be analyzed together with class and regression variables for the model. The data file can be in free format (columns are separated by at least one space) or in binary format.

Each record, i.e., line in a free format file, has been divided to two parts: 1) Integer number columns and 2) real number columns. Columns of real numbers are always after the integer number columns.

MACE.dat

```
1   1    56.0    10.0
2   1   -23.0    20.0
3   1     8.0    50.0
1   2     9.0   100.0
4   2     3.0    40.0
5   2   -11.0    20.0
```

Column 1: Bull (integer)

Column 2: Country (integer)
Column 3: Protein (real)
Column 4: Weight (real)

Pedigree file:

All the pedigree information must be given in the pedigree file. Each animal in the pedigree must have a record with four integers of which the forth integer is optional.

MACE.ped

```
 1     6      7     -5
 2     8      9     -5
 3    10      8     -5
 4    10     11     -6
 5     2      6     -6
 6    -1     -2     -6
 7    -1     -2     -6
 8    -1     -2     -6
 9    -3     -4     -6
10    -3     -4     -6
11    -3     -4     -6
```

Column 1: Animal ID
Column 2: Sire ID
Column 3: Maternal grand sire ID
Column 4: Phantom parent group for maternal grand dam

Variance component file:

The variance components file has variances and covariances for all the random effects in the model. The variance component file has a line for each (co)variance. Order of lines in the file is irrelevant.

MACE.var

```
1  1  1    100.0
1  2  1     20.0
1  2  2      5.0
2  1  1   1000.0
2  2  2     80.0
```

Column 1: Random effect number (integer)
Column 2: Row index (integer)
Column 3: Column index (integer)
Column 4: (Co)variance value (real)

Command file:

CLIM instructions for MACE model analysis. Everything beyond '#' sign is considered as a comment.

MACE.clm

```
TITLE     MACE, L.Schaeffer (1994)

DATAFILE  MACE.dat
INTEGER   bull country
REAL      protein weight

TRAITGROUP country

PEDFILE   MACE.ped       # Pedigree file
PEDIGREE  bull sm+p 1.0  # Genetics associated with pedigree:
                         # sm=sire model
PARFILE   MACE.var       # Variance component file

MODEL
  protein(1) = country bull ! WEIGHT=weight
  protein(2) = country bull ! WEIGHT=weight
```

Solution files

Structure of the formatted solution files depends on the model. Therefore, explanation of the content of those files is given in the printout of the particular run of the program.

MiX99-solver program has been run by command `mix99s -s`, meaning that in all parts of the program default values are used.

"Solfix"-file contains solutions for fixed effects.

```
 Fact. Trt      Level    N-Obs  Solution              Factor Trait
   1   1          1          3  10.497              COUNTRY PROTEIN
   1   2          2          3  1.2141              COUNTRY PROTEIN
```

Column 1: Factor number
Column 2: Trait number
Column 3: Level code
Column 4: Number of observations
Column 5: Solution
Column 6: Name of factor
Column 7: Name of trait

"Solani"-file contains solutions for genetic animal effect.

1	0	2	31.132	7.0211
2	1	1	-26.538	-5.9504
3	0	1	-2.4056	-.47722
4	0	1	4.3014	1.1245
5	0	1	-29.221	-7.0674
6	2	0	10.936	2.3169
7	1	0	8.9970	2.0117
8	2	0	-12.881	-2.9245
9	1	0	-8.3029	-1.8438
10	2	0	1.4727	0.43745
11	1	0	0.46456E-01	0.69527E-01
-4	3	0	-.49058	-.76316E-01
-3	3	0	-.98117	-.15263
-2	3	0	1.2948	0.27736
-1	3	0	2.5895	0.55472
-5	3	0	1.5631	0.39077
-6	8	0	-3.9756	-.99390

Column 1: Animal ID
Column 2: Number of descendants
Column 3: Number of observations
Column 4: Solution for trait 1 protein and factor bull
Column 5: Solution for trait 2 protein and factor bull