BIOS6643. L09 Specifying both G and R

The RANDOM statement may be used with TYPE=UN and possibly the GROUP= option to specify the among-individual covariance matrix G (possibly different by levels of GROUP).

The REPEATED statement may be used with various TYPE= specifications, and possibly the GROUP = option with SUBJECT = to specify the within-individual covariance matrix R_i.

```
proc import DATAFILE='C:\Users\juarezce\OneDrive - The University of Colorado Denver\BIOS6643\BIOS6643_
  replace out=dental0 dbms=csv; run;

data dental;
  set dental0;
  time=age;
run;

 proc print data=dental(obs=2);run;



  title '(a) DIAGONAL WITHIN-CHILD COVARIANCE MATRIX R_i';
title2 'WITH CONSTANT VARIANCE SAME FOR EACH GENDER';
title3 'SAME G MATRIX FOR BOTH GENDERS';
proc mixed method=ml data=dental;
  class gender id;
  model distance = gender gender*age / noint solution;
  random intercept age / type=un subject=id g gcorr v vcorr;

run;


/***************************************************************

   MODEL (b)

    Fit the same model as (a) but with a separate diagonal Ri matrix for
   each gender.  Thus, there are 2 separate variances sigma^2_(G and B)
   specified using GROUP=GENDER in the REPEATED statement


***************************************************************/

title '(b) DIAGONAL WITHIN-CHILD COVARIANCE MATRIX R_i';
title2 'WITH SEPARATE CONSTANT VARIANCE FOR EACH GENDER';
title3 'SAME G MATRIX FOR BOTH GENDERS';
proc mixed  method=ml data=dental;
  class  id gender;
```

```
   model distance = gender gender*age / noint solution;
   repeated / group=gender subject=id r=1,4 rcorr=1,4;
   random intercept age / type=un subject=id g gcorr v=1,4 vcorr=1,4;
run;
```

```
   /* */
```

Obs	id	age	distance	gender	time
1	1	8	21	Girls	8
2	1	10	20	Girls	10

(a) DIAGONAL WITHIN-CHILD COVARIANCE MATRIX R_i
WITH CONSTANT VARIANCE SAME FOR EACH GENDER
SAME G MATRIX FOR BOTH GENDERS

The Mixed Procedure

Model Information

Data Set	WORK.DENTAL
Dependent Variable	distance
Covariance Structure	Unstructured
Subject Effect	id
Estimation Method	ML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Containment

Class Level Information

Class	Levels	Values
gender	2	Boys Girls
id	27	1 10 11 12 13 14 15 16 17 18 19 2 20 21 22 23 24 25 26 27 3 4 5 6 7 8 9

Dimensions

Covariance Parameters	4
Columns in X	4
Columns in Z per Subject	2
Subjects	27
Max Obs per Subject	4

Number of Observations

```
          Number of Observations Read            108
          Number of Observations Used            108
          Number of Observations Not Used          0

                    Iteration History

   Iteration    Evaluations        -2 Log Like       Criterion

        0              1         478.24175986
        1              1         427.80595080       0.00000000

              Convergence criteria met.

                  Estimated G Matrix

Row Effect          id                          Col1      Col2

 1 Intercept        1                         4.5569   -0.1983
 2 age              1                        -0.1983   0.02376

            Estimated G Correlation Matrix

Row Effect          id                          Col1      Col2

 1 Intercept        1                         1.0000   -0.6025
 2 age              1                        -0.6025    1.0000

              Estimated V Matrix for id 1

        Row      Col1      Col2      Col3      Col4

         1      4.6216    2.8891    2.8727    2.8563
         2      2.8891    4.6839    3.0464    3.1251
         3      2.8727    3.0464    4.9363    3.3938
         4      2.8563    3.1251    3.3938    5.3788

          Estimated V Correlation Matrix for id 1

        Row      Col1      Col2      Col3      Col4

         1      1.0000    0.6209    0.6014    0.5729
         2      0.6209    1.0000    0.6335    0.6226
         3      0.6014    0.6335    1.0000    0.6586
         4      0.5729    0.6226    0.6586    1.0000

            Covariance Parameter Estimates

           Cov Parm     Subject     Estimate

           UN(1,1)        id          4.5569
           UN(2,1)        id         -0.1983
           UN(2,2)        id         0.02376
           Residual                  1.7162
```

```
                        Fit Statistics

              -2 Log Likelihood                427.8
              AIC (Smaller is Better)          443.8
              AICC (Smaller is Better)         445.3
              BIC (Smaller is Better)          454.2


                Null Model Likelihood Ratio Test


                DF     Chi-Square      Pr > ChiSq


                3        50.44           <.0001


                Solution for Fixed Effects


                                Standard
Effect        gender    Estimate     Error      DF    t Value    Pr > |t|


gender        Boys       16.3406     0.9801      54    16.67      <.0001
gender        Girls      17.3727     1.1820      54    14.70      <.0001
age*gender    Boys        0.7844     0.08275     54     9.48      <.0001
age*gender    Girls       0.4795     0.09980     54     4.80      <.0001


                Type 3 Tests of Fixed Effects


                    Num     Den
         Effect      DF      DF     F Value    Pr > F


         gender       2      54     247.00     <.0001
         age*gender   2      54      56.46     <.0001




        (b) DIAGONAL WITHIN-CHILD COVARIANCE MATRIX R_i
         WITH SEPARATE CONSTANT VARIANCE FOR EACH GENDER
                SAME G MATRIX FOR BOTH GENDERS


                   The Mixed Procedure


                   Model Information


     Data Set                 WORK.DENTAL
     Dependent Variable       distance
     Covariance Structures    Unstructured, Variance
                              Components
     Subject Effects          id, id
     Group Effect             gender
     Estimation Method        ML
     Residual Variance Method None
     Fixed Effects SE Method  Model-Based
     Degrees of Freedom Method Containment


                  Class Level Information
```

```
     Class       Levels     Values

     id             27      1 10 11 12 13 14 15 16 17 18
                            19 2 20 21 22 23 24 25 26 27 3
                            4 5 6 7 8 9
     gender          2      Boys Girls


                         Dimensions

          Covariance Parameters         5
          Columns in X                  4
          Columns in Z per Subject      2
          Subjects                     27
          Max Obs per Subject           4


                   Number of Observations

       Number of Observations Read          108
       Number of Observations Used          108
       Number of Observations Not Used        0


                      Iteration History

   Iteration     Evaluations        -2 Log Like        Criterion

          0             1         478.24175986
          1             2         418.92503842        1.16632499
          2             1         416.18869903        1.23326209
          3             1         407.89638533        0.01954268
          4             2         406.88264563        0.00645800
          5             1         406.10632159        0.00056866
          6             1         406.04318997        0.00000764
          7             1         406.04238894        0.00000000


                  Convergence criteria met.

              Estimated R Matrix for id 1

     Row       Col1        Col2        Col3        Col4

      1      0.4449
      2                   0.4449
      3                               0.4449
      4                                           0.4449


           Estimated R Correlation Matrix for id 1

     Row       Col1        Col2        Col3        Col4

      1      1.0000
      2                   1.0000
      3                               1.0000
      4                                           1.0000
```

```
                        Estimated G Matrix

Row Effect              id                          Col1     Col2

 1 Intercept            1                          3.1978  -0.1103
 2 age                  1                         -0.1103  0.01976

                  Estimated G Correlation Matrix

Row Effect              id                          Col1     Col2

 1 Intercept            1                          1.0000  -0.4388
 2 age                  1                         -0.4388   1.0000

                  Estimated V Matrix for id 1

        Row        Col1       Col2       Col3       Col4

          1      3.1426     2.7933     2.8889     2.9845
          2      2.7933     3.4128     3.1426     3.3172
          3      2.8889     3.1426     3.8411     3.6499
          4      2.9845     3.3172     3.6499     4.4275

             Estimated V Correlation Matrix for id 1

        Row        Col1       Col2       Col3       Col4

          1      1.0000     0.8529     0.8315     0.8001
          2      0.8529     1.0000     0.8680     0.8534
          3      0.8315     0.8680     1.0000     0.8851
          4      0.8001     0.8534     0.8851     1.0000

                  Estimated R Matrix for id 12

        Row        Col1       Col2       Col3       Col4

          1      2.6294
          2                 2.6294
          3                            2.6294
          4                                       2.6294

             Estimated R Correlation Matrix for id 12

        Row        Col1       Col2       Col3       Col4

          1      1.0000
          2                 1.0000
          3                            1.0000
          4                                       1.0000

                  Estimated V Matrix for id 12

        Row        Col1       Col2       Col3       Col4
```

```
      1        5.3271        2.7933        2.8889        2.9845
      2        2.7933        5.5973        3.1426        3.3172
      3        2.8889        3.1426        6.0256        3.6499
      4        2.9845        3.3172        3.6499        6.6120
```

Estimated V Correlation Matrix for id 12

Row	Col1	Col2	Col3	Col4
1	1.0000	0.5115	0.5099	0.5029
2	0.5115	1.0000	0.5411	0.5453
3	0.5099	0.5411	1.0000	0.5782
4	0.5029	0.5453	0.5782	1.0000

Covariance Parameter Estimates

Cov Parm	Subject	Group	Estimate
UN(1,1)	id		3.1978
UN(2,1)	id		-0.1103
UN(2,2)	id		0.01976
Residual	id	gender Boys	2.6294
Residual	id	gender Girls	0.4449

Fit Statistics

-2 Log Likelihood	406.0
AIC (Smaller is Better)	424.0
AICC (Smaller is Better)	425.9
BIC (Smaller is Better)	435.7

Null Model Likelihood Ratio Test

DF	Chi-Square	Pr > ChiSq
4	72.20	<.0001

Solution for Fixed Effects

Effect	gender	Estimate	Standard Error	DF	t Value	Pr > |t|
gender	Boys	16.3406	1.1114	54	14.70	<.0001
gender	Girls	17.3727	0.7386	54	23.52	<.0001
age*gender	Boys	0.7844	0.09722	54	8.07	<.0001
age*gender	Girls	0.4795	0.06180	54	7.76	<.0001

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
gender	2	54	384.72	<.0001
age*gender	2	54	62.66	<.0001

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