

Command File (.as file)

- The command file has three main parts
 1. Data input and transformation
 2. Model specification
 3. Variance specification
- Consider an experiment comparing the oxygen consumption of four species of frog.(Zar (1999))¹

¹Original data was obtained from <http://www.statsci.org/data/general/frogs.html>

Frog example

- Dependent Variable
 - Oxygen Consumption
- Fixed Effects
 - Species (4 levels)
 - Temperature (Low and High)
 - Exercise (Rest and Exercise)
- Random effects
 - Frog (nested w/in Species and Temperature)
 - Error

Data

Subject	Species	Temperature	Rest	Exercise
1	1	Low	0.107	0.152
2	1	Low	0.114	0.163
3	1	High	0.133	0.194
...				

- Rest Resting oxygen consumption
- Exercise Exercise oxygen consumption
- One record/subject
- Tab delimited

Data input

SAS

```
data frogs;
  length cond $ 8;
  infile "frogs.txt" expandtabs firstobs=2;
  input frog species temp $ rest exercise;
  restC=rest-0.1358125;
  rest2=restc*restc-0.000810277;
proc means;var rest restc rest2;
```

ASReml

Oxygen consumption of frogs

Frog * !I

Species 4 !I

Temp 2 !A

Rest # Resting oxygen consumption

Exercise # Exercise oxygen consumption

RestC !=Rest !- 0.1358125

Rest2 !=Rest !^2 !- 0.000810277

frogs.txt !SKIP 1 # !MAXIT 100 !EXTRA 5

Model Specification

SAS

```
proc mixed data=frogs;  
  class frog species temp;  
  model exercise=species|temp Rest Rest*Rest/ddfm=kr solution;  
  lsmeans Species/diff at means;  
run;
```

ASReml

Model Equation

```
frogs.txt !SKIP 1  
Exercise ~ mu Species*Temp Rest*Rest
```

- * Expands into main affects and interactions.
- mu Automatic variable

Variance structure

```
0 0 0
```

Least Square Means

```
predict Species !TDIFF
```

- For the two-way table: `predict Species Temp`
- Evaluate at `Temp = Low` `predict Species Temp "Low`
- Evaluate at `Rest=.1` `predict Species Rest .1`

R header Line

0 0 0 or s d g

- s Number of heterogeneous R groups (Usually 1)

Zero in our case says $e \sim N(\mathbf{0}, I\sigma^2)$

- d Number terms in the direct product (Usually 1 or 2)

Zero in our case since we are using the default covariance structure

- g Number of random effects

We have zero random effects

Complete Program

```
Oxygen consumption of frogs
Frog * !I
Species 4 !I
Temp 2 !A
Rest # Resting oxygen consumption
Exercise # Exercise oxygen consumption
RestC !=Rest !- 0.1358125
Rest2 !=Rest !^2 !- 0.000810277
frogs.txt !SKIP 1
Exercise ~ mu Species*Temp Rest*Rest
predict Species !TDIFF
0 0 0
```

Results

Class Level Information

Class	Levels	Values
frog	16	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
species	4	1 2 3 4
temp	2	High Low

Dimensions

Covariance Parameters	1
Columns in X	17
Columns in Z	0
Subjects	1
Max Obs Per Subject	16

Number of Observations

Number of Observations Read	16
Number of Observations Used	16
Number of Observations Not Used	0

ASReml (.asr file)

Using 16 records of 16 read

Model term	Size	#miss	#zero	MinNon0	Mean	MaxNon0		
1 Frog	16	0	0	1	8.5000	16		
2 Species	4	0	0	1	2.5000	4		
3 Temp	2	0	0	1	1.5000	2		
4 Rest		0	0	0.9300E-01	0.1358	0.1920		
5 Exercise	Variate	0	0	0.1360	0.1859	0.2440		
6 RestC		0	0	-0.4281E-01	0.000	0.5619E-01		
7 Rest2		0	0	0.7839E-02	0.1845E-01	0.3605E-01		
8 mu	1							
9 Species.Temp	8	2	Species	:	4	3 Temp	:	2
10 Rest.Rest	1	4	Rest	:	1	4 Rest	:	1

Forming 17 equations: 17 dense.

Covariance Parameter
Estimates

Cov Parm	Estimate
Residual	0.000019

Fit Statistics

-2 Res Log Likelihood	-65.1
AIC (smaller is better)	-63.1
AICC (smaller is better)	-62.1
BIC (smaller is better)	-63.3

Initial updates will be shrunk by factor 0.316

Notice: 7 singularities detected in design matrix.

1 LogL= 38.0774 S2= 0.18552E-04 6 df 1.000

2 LogL= 38.0774 S2= 0.18552E-04 6 df 1.000

Final parameter values 1.0000

Source	Model	terms	Gamma	Component	Comp/SE	% C
Variance	16	6	1.00000	0.185522E-04	1.73	0 P

Solution for Fixed Effects

Effect	temp	species	Estimate	Standard Error	DF	t Value	Pr > |t|
Intercept			-0.1793	0.1098	6	-1.63	0.1536
species		1	0.000387	0.01088	6	0.04	0.9728
species		2	0.01001	0.01678	6	0.60	0.5724
species		3	0.003328	0.005753	6	0.58	0.5840
species		4	0	.	.	.	.
temp	High		0.03290	0.01611	6	2.04	0.0872
temp	Low		0	.	.	.	.
species*temp	High	1	-0.02780	0.01788	6	-1.55	0.1711
species*temp	Low	1	0	.	.	.	.
species*temp	High	2	-0.03749	0.02046	6	-1.83	0.1166
species*temp	Low	2	0	.	.	.	.
species*temp	High	3	-0.04268	0.01165	6	-3.66	0.0105
species*temp	Low	3	0	.	.	.	.
species*temp	High	4	0	.	.	.	.
species*temp	Low	4	0	.	.	.	.
rest			4.4724	1.5097	6	2.96	0.0252
rest*rest			-12.9063	5.3263	6	-2.42	0.0516

Solution File (.sln)

Rest.Rest	1.001	-12.91	5.326
Rest	1	4.472	1.510
Species.Temp	1.Low	0.000	0.000
Species.Temp	1.High	0.000	0.000
Species.Temp	2.Low	0.000	0.000
Species.Temp	2.High	-0.9694E-02	0.6781E-02
Species.Temp	3.Low	0.000	0.000
Species.Temp	3.High	-0.1489E-01	0.9201E-02
Species.Temp	4.Low	0.000	0.000
Species.Temp	4.High	0.2780E-01	0.1788E-01
Temp	Low	0.000	0.000
Temp	High	0.5103E-02	0.8940E-02
Species	1	0.000	0.000
Species	2	0.9628E-02	0.8151E-02
Species	3	0.2941E-02	0.7974E-02
Species	4	-0.3871E-03	0.1088E-01
mu	1	-0.1789	0.1032

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
species	3	6	3.08	0.1116
temp	1	6	0.63	0.4585
species*temp	3	6	9.25	0.0114
rest	1	6	8.78	0.0252
rest*rest	1	6	5.87	0.0516

Back to the results file (.asr)

Analysis of Variance	NumDF	DenDF	F_inc	Prob
8 mu	1	6.0	29816.58	<.001
2 Species	3	6.0	160.85	<.001
3 Temp	1	6.0	182.89	<.001
9 Species.Temp	3	6.0	9.26	0.011
4 Rest	1	6.0	12.30	0.013
10 Rest.Rest	1	6.0	5.87	0.052

Notice: The DenDF values are calculated ignoring fixed/boundary/singular variance parameters using algebraic derivatives.

Least Squares Means

Effect	species	rest	Estimate	Standard Error	DF	t Value	Pr > |t|
species	1	0.14	0.1929	0.004371	6	44.14	<.0001
species	2	0.14	0.1977	0.01057	6	18.70	<.0001
species	3	0.14	0.1884	0.003877	6	48.60	<.0001
species	4	0.14	0.2065	0.01036	6	19.92	<.0001

Differences of Least Squares Means

Effect	species	_species	rest	Estimate	Standard Error	DF	t Value	Pr > |t|
species	1	2	0.14	-0.00478	0.007245	6	-0.66	0.5339
species	1	3	0.14	0.004504	0.006629	6	0.68	0.5222
species	1	4	0.14	-0.01351	0.01203	6	-1.12	0.3042
species	2	3	0.14	0.009284	0.01216	6	0.76	0.4741

ASReml Predicted Values (.pvs file)

Oxygen consumption of frogs

frogs

Ecode is E for Estimable, * for Not Estimable

----- 1 -----

Predicted values of Exercise

Rest is evaluated at average value of 0.1358

Temp is averaged over fixed levels

The cells of the hypertable are calculated from all model terms constructed solely from factors in the averaging and classify sets.

Species		Predicted_Value	Standard_Error	Ecode
	1	0.1929	0.0044	E
	2	0.1977	0.0106	E
	3	0.1884	0.0039	E
	4	0.2065	0.0104	E

SED: Standard Error of Difference:

Min	0.0066	Mean	0.0102	Max	0.0158
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Predicted values with t statistics

0.1929

0.1977 0.66

0.1884 -0.68 -0.76

0.2065 1.12 0.55 2.36