```
3          /*
4          Examine differences among the following 6 treatments
5           N/N85 fed normally before weaning and 85 kcal/wk after
6           N/R40 fed normally before weaning and 40 kcal/wk after
7           N/R50 fed normally before weaning and 50 kcal/wk after
8           NP    standard diet to satiation
9           R/R50 fed a reduced diet of 50 kcal/wk before and after weaning
10          lopro fed normally before weaning and 50 kcal/wk after and dietary protein decreasing
10        ! with age
11
12          Variable of interest - Lifetime of mice (in months) fed on three different diet
12        ! regimens.
13         */
14
15         /*
16         SAS applications of note:
17            FORMCHAR option
18            contrast statements
19            lsmeans
20            Saxton's Macro
21         */
22
23
24         dm'log;clear;output;clear';
25         options ps=512 ls=132 nocenter nodate nonumber nolabel;
26         OPTIONS FORMCHAR="|----|+|---+=|-/\<>*";
27         ODS HTML style=minimal rs=none
body='C:\Geaghan\Current\EXST3201\Fall2005\SAS\MouseDiet03.html' ;
NOTE: Writing HTML Body file:
C:\Geaghan\Current\EXST3201\Fall2005\SAS\MouseDiet03.html
28
29         Title1 'Chapter 5 : Mouse feeding example';
30         filename mousein
'C:\Geaghan\Current\EXST3201\Datasets\ASCII\CASE0501.csv';
31
32         data MouseDiet; infile mousein missover DSD dlm="," firstobs=2;
33           input LIFETIME DIET $;
34         datalines;
NOTE: The infile MOUSEIN is:
      File Name=C:\Geaghan\Current\EXST3201\Datasets\ASCII\CASE0501.csv,
      RECFM=V,LRECL=256
NOTE: 349 records were read from the infile MOUSEIN.
      The minimum record length was 7.
      The maximum record length was 12.
NOTE: The data set WORK.MOUSEDIET has 349 observations and 2 variables.
NOTE: DATA statement used (Total process time):
      real time           0.01 seconds
      cpu time            0.01 seconds
35         ;
36
37         proc mixed data=MouseDiet cl covtest;
38            Title2 'Analysis of Variance with PROC MIXED';
39            class diet;
40            model lifetime = diet;
41         run;
NOTE: The PROCEDURE MIXED printed page 1.
NOTE: PROCEDURE MIXED used (Total process time):
      real time           0.04 seconds
      cpu time            0.04 seconds
```

Chapter 5 : Mouse feeding example
Analysis of Variance with PROC MIXED

The Mixed Procedure

Model Information

Data Set	WORK.MOUSEDIET
Dependent Variable	LIFETIME
Covariance Structure	Diagonal
Estimation Method	REML
Residual Variance Method	Profile
Fixed Effects SE Method	Model-Based
Degrees of Freedom Method	Residual

Class Level Information

Class	Levels	Values
DIET	6	N/N85 N/R40 N/R50 NP R/R50 lopro

Dimensions

Covariance Parameters	1
Columns in X	7
Columns in Z	0
Subjects	1
Max Obs Per Subject	349

Number of Observations

Number of Observations Read	349
Number of Observations Used	349
Number of Observations Not Used	0

Covariance Parameter Estimates

Cov Parm	Estimate	Standard Error	Z Value	Pr Z	Alpha	Lower	Upper
Residual	44.5989	3.4056	13.10	<.0001	0.05	38.6102	52.1055

Fit Statistics

-2 Res Log Likelihood	2300.3
AIC (smaller is better)	2302.3
AICC (smaller is better)	2302.4
BIC (smaller is better)	2306.2

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	5	343	57.10	<.0001

```
42
43         proc mixed data=MouseDiet cl covtest;
44            Title2 'Testing homogeniety of Variance with PROC MIXED';
45            class diet;
46            model lifetime = diet / ddfm=kr;
47            repeated / group=diet;
48         run;
NOTE: Convergence criteria met.
NOTE: The PROCEDURE MIXED printed page 2.
NOTE: PROCEDURE MIXED used (Total process time):
      real time           0.04 seconds
      cpu time            0.04 seconds
```

Chapter 5 : Mouse feeding example
Testing homogeniety of Variance with PROC MIXED

The Mixed Procedure

Model Information

Data Set	WORK.MOUSEDIET
Dependent Variable	LIFETIME
Covariance Structure	Variance Components
Group Effect	DIET
Estimation Method	REML
Residual Variance Method	None
Fixed Effects SE Method	Prasad-Rao-Jeske-Kackar-Harville
Degrees of Freedom Method	Kenward-Roger

Class Level Information

Class	Levels	Values
DIET	6	N/N85 N/R40 N/R50 NP R/R50 lopro

Dimensions

Covariance Parameters	6
Columns in X	7
Columns in Z	0
Subjects	349
Max Obs Per Subject	1

Number of Observations

Number of Observations Read	349
Number of Observations Used	349
Number of Observations Not Used	0

Iteration History

Iteration	Evaluations	-2 Res Log Like	Criterion
0	1	2300.34852165	
1	1	2289.27652629	0.00000000

Convergence criteria met.

Covariance Parameter Estimates

Cov Parm	Group	Estimate	Standard Error	Z Value	Pr Z	Alpha	Lower	Upper
Residual	DIET N/N85	26.2687	4.9643	5.29	<.0001	0.05	18.7234	39.5319
Residual	DIET N/R40	44.9356	8.2733	5.43	<.0001	0.05	32.2855	66.8452
Residual	DIET N/R50	60.3448	10.2001	5.92	<.0001	0.05	44.4538	86.6356
Residual	DIET NP	37.6223	7.6796	4.90	<.0001	0.05	26.1635	58.7189
Residual	DIET R/R50	44.6645	8.5172	5.24	<.0001	0.05	31.7464	67.4911
Residual	DIET lopro	48.8838	9.3218	5.24	<.0001	0.05	34.7453	73.8667

Fit Statistics

-2 Res Log Likelihood	2289.3
AIC (smaller is better)	2301.3
AICC (smaller is better)	2301.5
BIC (smaller is better)	2324.4

Null Model Likelihood Ratio Test

DF	Chi-Square	Pr > ChiSq
5	11.07	0.0500

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	5	155	64.71	<.0001

```
50         proc mixed data=MouseDiet cl covtest;
51            class diet;
52            model lifetime = diet / ddfm=kr;
53            repeated / group=diet;
54           *** diet treatments              N/N85 N/R40 N/R50 NP R/R50 lopro;
55            contrast 'A: N/N85 N/R50' diet     -1    0    1    0    0     0;
56            contrast 'B: N/R50 R/R50' diet      0    0   -1    0    1     0;
57            contrast 'C: N/R40 N/R50' diet      0   -1    1    0    0     0;
58            contrast 'D: N/R50 lopro' diet      0    0   -1    0    0     1;
59            contrast 'E: N/N85 NP'    diet     -1    0    0    1    0     0;
60         run;

NOTE: Convergence criteria met.
NOTE: The PROCEDURE MIXED printed page 3.
NOTE: PROCEDURE MIXED used (Total process time):
      real time           0.04 seconds
      cpu time            0.04 seconds



Chapter 5 : Mouse feeding example
Testing homogeniety of Variance with PROC MIXED

The Mixed Procedure

                  Model Information
Data Set                      WORK.MOUSEDIET
Dependent Variable            LIFETIME
Covariance Structure          Variance Components
Group Effect                  DIET
Estimation Method             REML
Residual Variance Method      None
Fixed Effects SE Method       Prasad-Rao-Jeske-
                              Kackar-Harville
Degrees of Freedom Method     Kenward-Roger

             Class Level Information
Class    Levels    Values
DIET          6    N/N85 N/R40 N/R50 NP R/R50 lopro

            Dimensions
Covariance Parameters             6
Columns in X                      7
Columns in Z                      0
Subjects                        349
Max Obs Per Subject               1

          Number of Observations
Number of Observations Read             349
Number of Observations Used             349
Number of Observations Not Used           0

                     Iteration History

Iteration    Evaluations    -2 Res Log Like       Criterion
        0              1      2300.34852165
        1              1      2289.27652629      0.00000000

                  Convergence criteria met.
```

Covariance Parameter Estimates

Cov Parm	Group	Estimate	Standard Error	Z Value	Pr Z	Alpha	Lower	Upper
Residual	DIET N/N85	26.2687	4.9643	5.29	<.0001	0.05	18.7234	39.5319
Residual	DIET N/R40	44.9356	8.2733	5.43	<.0001	0.05	32.2855	66.8452
Residual	DIET N/R50	60.3448	10.2001	5.92	<.0001	0.05	44.4538	86.6356
Residual	DIET NP	37.6223	7.6796	4.90	<.0001	0.05	26.1635	58.7189
Residual	DIET R/R50	44.6645	8.5172	5.24	<.0001	0.05	31.7464	67.4911
Residual	DIET lopro	48.8838	9.3218	5.24	<.0001	0.05	34.7453	73.8667

Fit Statistics

-2 Res Log Likelihood	2289.3
AIC (smaller is better)	2301.3
AICC (smaller is better)	2301.5
BIC (smaller is better)	2324.4

Null Model Likelihood Ratio Test

DF	Chi-Square	Pr > ChiSq
5	11.07	0.0500

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	5	155	64.71	<.0001

Contrasts

Label	Num DF	Den DF	F Value	Pr > F
A: N/N85 N/R50	1	122	70.40	<.0001
B: N/R50 R/R50	1	124	0.21	0.6474
C: N/R40 N/R50	1	129	4.97	0.0275
D: N/R50 lopro	1	123	3.96	0.0489
E: N/N85 NP	1	93.9	22.77	<.0001

```
61
62         Title2 'Analysis wtih PROC GLM';
63         proc glm data=MouseDiet;
64            class diet;
65            model lifetime = diet;
66           *** diet treatments              N/N85 N/R40 N/R50 NP R/R50 lopro;
67            contrast 'A: N/N85 N/R50' diet    -1    0    1    0    0     0;
68            contrast 'B: N/R50 R/R50' diet     0    0   -1    0    1     0;
69            contrast 'C: N/R40 N/R50' diet     0   -1    1    0    0     0;
70            contrast 'D: N/R50 lopro' diet     0    0   -1    0    0     1;
71            contrast 'E: N/N85 NP'    diet    -1    0    0    1    0     0;
72         run;
73
NOTE: The PROCEDURE GLM printed pages 4-5.
NOTE: PROCEDURE GLM used (Total process time):
      real time           0.03 seconds
      cpu time            0.03 seconds
```

```
Chapter 5 : Mouse feeding example
Analysis wtih PROC GLM

The GLM Procedure

                Class Level Information
Class         Levels    Values
DIET               6    N/N85 N/R40 N/R50 NP R/R50 lopro

Number of Observations Read         349
Number of Observations Used         349



Dependent Variable: LIFETIME
                                      Sum of
Source                     DF         Squares     Mean Square    F Value    Pr > F
Model                       5     12733.94181      2546.78836      57.10    <.0001
Error                     343     15297.41532        44.59888

Corrected Total           348     28031.35713

R-Square     Coeff Var      Root MSE    LIFETIME Mean
0.454275      17.21323      6.678239         38.79713

Source                     DF       Type I SS     Mean Square    F Value    Pr > F
DIET                        5     12733.94181      2546.78836      57.10    <.0001

Source                     DF     Type III SS     Mean Square    F Value    Pr > F
DIET                        5     12733.94181      2546.78836      57.10    <.0001

Contrast                   DF     Contrast SS     Mean Square    F Value    Pr > F
A: N/N85 N/R50              1     2917.456121     2917.456121      65.42    <.0001
B: N/R50 R/R50              1       10.843803       10.843803       0.24    0.6223
C: N/R40 N/R50              1      258.510054      258.510054       5.80    0.0166
D: N/R50 lopro              1      213.507110      213.507110       4.79    0.0293
E: N/N85 NP                 1      737.128081      737.128081      16.53    <.0001



74         proc mixed data=MouseDiet cl covtest;
75            class diet;
76            model lifetime = diet / ddfm=kr;
77            repeated / group=diet;
78           ***Alternative hypotheses     N/N85  N/R40  N/R50   NP  R/R50  lopro;
79            contrast '1' diet             -1     0.5    0.5     0      0     0;
80            contrast '2' diet             -2       1      1     0      0     0;
81            contrast '3' diet            0.2     0.2    0.2   0.2    0.2    -1;
82            contrast '4' diet              1       1      1     1      1    -5;
83            contrast '5' diet           -0.5    0.25   0.25  -0.5   0.25  0.25;
84            contrast '6' diet             -2       1      1    -2      1     1;
85            contrast '7' diet           -0.5   0.333  0.333  -0.5  0.333     0;
86            contrast '8' diet             -3       2      2    -3      2     0;
87         run;
NOTE: Convergence criteria met.
NOTE: The PROCEDURE MIXED printed page 6.
NOTE: PROCEDURE MIXED used (Total process time):
      real time           0.04 seconds
      cpu time            0.04 seconds
```

Chapter 5 : Mouse feeding example
Analysis wtih PROC GLM

The Mixed Procedure

Model Information

Data Set	WORK.MOUSEDIET
Dependent Variable	LIFETIME
Covariance Structure	Variance Components
Group Effect	DIET
Estimation Method	REML
Residual Variance Method	None
Fixed Effects SE Method	Prasad-Rao-Jeske-Kackar-Harville
Degrees of Freedom Method	Kenward-Roger

Class Level Information

Class	Levels	Values
DIET	6	N/N85 N/R40 N/R50 NP R/R50 lopro

Dimensions

Covariance Parameters	6
Columns in X	7
Columns in Z	0
Subjects	349
Max Obs Per Subject	1

Number of Observations

Number of Observations Read	349
Number of Observations Used	349
Number of Observations Not Used	0

Iteration History

Iteration	Evaluations	-2 Res Log Like	Criterion
0	1	2300.34852165	
1	1	2289.27652629	0.00000000

Convergence criteria met.

Covariance Parameter Estimates

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Residual	DIET N/R40	44.9356	8.2733	5.43	<.0001	0.05	32.2855	66.8452
Residual	DIET N/R50	60.3448	10.2001	5.92	<.0001	0.05	44.4538	86.6356
Residual	DIET NP	37.6223	7.6796	4.90	<.0001	0.05	26.1635	58.7189
Residual	DIET R/R50	44.6645	8.5172	5.24	<.0001	0.05	31.7464	67.4911
Residual	DIET lopro	48.8838	9.3218	5.24	<.0001	0.05	34.7453	73.8667

Fit Statistics

-2 Res Log Likelihood	2289.3
AIC (smaller is better)	2301.3
AICC (smaller is better)	2301.5
BIC (smaller is better)	2324.4

Null Model Likelihood Ratio Test

DF	Chi-Square	Pr > ChiSq
5	11.07	0.0500

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
DIET	5	155	64.71	<.0001

Contrasts

Label	Num DF	Den DF	F Value	Pr > F
1	1	147	141.01	<.0001
2	1	147	141.01	<.0001
3	1	74.4	2.54	0.1154
4	1	74.4	2.54	0.1154
5	1	221	303.02	<.0001
6	1	221	303.02	<.0001
7	.	.	.	.
8	1	236	312.50	<.0001