Validation of 'sasLM' Package

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Contents

1 Tested Version and Books used for the Validation

1.1 Packages Used

- 'sasLM' version: 0.2.0
- 'SAS' version: 9.4 Licensed and University Edition
- 'car' version: 3.0.7
- R version: R version 3.6.3 (2020-02-29)

The 'car' package is not necessary for 'sasLM.' It is used for the comparison of the results.

If you see any difference betwwen 'car' and 'sasLM', 'SAS' results coincide with 'sasLM', not with 'car.'

Before 'sasLM' is available on CRAN, you can download using the following command in R.

```r
install.packages("sasLM", repos="http://r.acr.kr")
```

1.2 Books and Articles used for the Test

1. Harvey WR. Least-Squares Analysis of Data with Unequal Subclass Frequencies. USDA, Agriculture Research Service, ARS 20-8. 1960. reprinted with corrections as ARS H-4, 1975, also reprinted 1979.

2. Snee RD. Computation and Use of Expected Mean Squares in Analysis of Variance. J Qual Tech. 1974:6(3);128-137.

3. Goodnight JH. The General Linear Models Procedure, Proceedings of the First International SAS User's Group, SAS Institute, Raleigh, N.C. 1976.

4. Littell RC, Stroup WW, Freund RJ. SAS for Linear Models 4e. John Wiley & Sons Inc. 2002.

5. Sahai H, Ojeda MM. Analysis of Variance for Random Models Volume 2 Unbalanced Data. 2005.

6. Federer WT, King F. Variations on Split Plot and Split Block Experiment Designs. John Wiley & Sons Inc. 2007.

7. Hinkelmann K, Kempthorne O. Design and Analysis of Experiments Volume 1 Introduction to Experimental Design. 2e. John Wiley & Sons Inc. 2008.

8. Hinkelmann K, Kempthorne O. Design and Analysis of Experiments Volume 2 Advanced Experimental Design. John Wiley & Sons Inc. 2005.

9. Lawson J. Design and Analysis of Experiments with SAS. Taylor and Francis Group. 2010.

10. Searle SR, Gruber MHJ. Linear Models 2e, Kindle Edition. John Wiley & Sons Inc. 2016.

2 ARS20-8

Reference

- Harvey WR. Least-Squares Analysis of Data with Unequal Subclass Frequencies. USDA, Agriculture Research Service, ARS 20-8. 1960. reprinted with corrections as ARS H-4, 1975, also reprinted 1979.

2.1 p8

(1) MODEL

```
p8 = read.csv("C:/G/Rt/ANOVA/ARS20-8p8.csv")
p8 = af(p8, c("PigNo", "Ration"))
GLM(Barrow ~ Ration, p8)
```

```
$ANOVA
Response : Barrow
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL            2 11.111   5.5556  1.2626 0.3113
RESIDUALS       15 66.000   4.4000
CORRECTED TOTAL 17 77.111


$`Type I`
       Df Sum Sq Mean Sq F value Pr(>F)
Ration  2 11.111  5.5556  1.2626 0.3113


$`Type II`
       Df Sum Sq Mean Sq F value Pr(>F)
Ration  2 11.111  5.5556  1.2626 0.3113


$`Type III`
       Df Sum Sq Mean Sq F value Pr(>F)
Ration  2 11.111  5.5556  1.2626 0.3113


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)        5    0.85635  5.8387 3.261e-05 ***
Ration1           -1    1.35401 -0.7385    0.4716
Ration2            1    1.13284  0.8827    0.3913
Ration3            0    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

2.2 p42

(2) MODEL

```
p42 = read.csv("C:/G/Rt/ANOVA/ARS20-8p42.csv")
p42 = af(p42, c("Ration", "Pig", "Sire"))
GLM(Y ~ Sire + Ration, p42)
```

$ANOVA
Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	3	20.819	6.9397	1.7259	0.2075
RESIDUALS	14	56.292	4.0209		
CORRECTED TOTAL	17	77.111			

$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Sire	2	11.1111	5.5556	1.3817	0.2834
Ration	1	9.7079	9.7079	2.4144	0.1425

$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Sire	2	15.6829	7.8414	1.9502	0.1790
Ration	1	9.7079	9.7079	2.4144	0.1425

$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Sire	2	15.6829	7.8414	1.9502	0.1790
Ration	1	9.7079	9.7079	2.4144	0.1425

$Parameter

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	5.2697	0.83682	6.2973	1.964e-05	***
Sire1	-0.4607	1.34009	-0.3438	0.7361	
Sire2	1.7416	1.18344	1.4716	0.1632	
Sire3	0.0000	0.00000			
Ration1	-1.6180	1.04129	-1.5538	0.1425	
Ration2	0.0000	0.00000			

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

  (3) MODEL

```
GLM(Y ~ Sire + Ration + Sire:Ration, p42)
```

$ANOVA
Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	5	51.044	10.2089	4.6997	0.01311 *
RESIDUALS	12	26.067	2.1722		
```

```
CORRECTED TOTAL 17 77.111
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
            Df  Sum Sq Mean Sq F value   Pr(>F)
Sire         2 11.1111  5.5556  2.5575 0.118799
Ration       1  9.7079  9.7079  4.4691 0.056129 .
Sire:Ration  2 30.2255 15.1127  6.9573 0.009859 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
            Df  Sum Sq Mean Sq F value   Pr(>F)
Sire         2 15.6829  7.8414  3.6099 0.059238 .
Ration       1  9.7079  9.7079  4.4691 0.056129 .
Sire:Ration  2 30.2255 15.1127  6.9573 0.009859 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
            Df  Sum Sq Mean Sq F value   Pr(>F)
Sire         2 21.0007 10.5004  4.8339 0.028853 *
Ration       1  3.5919  3.5919  1.6535 0.222736
Sire:Ration  2 30.2255 15.1127  6.9573 0.009859 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
              Estimate Std. Error t value  Pr(>|t|)
(Intercept)     5.4000    0.65912  8.1927 2.944e-06 ***
Sire1          -2.9000    1.23311 -2.3518   0.03659 *
Sire2           2.9333    1.07634  2.7253   0.01843 *
Sire3           0.0000    0.00000
Ration1        -2.4000    1.61452 -1.4865   0.16294
Ration2         0.0000    0.00000
Sire1:Ration1   5.4000    2.18607  2.4702   0.02948 *
Sire1:Ration2   0.0000    0.00000
Sire2:Ration1  -1.3333    1.94041 -0.6871   0.50506
Sire2:Ration2   0.0000    0.00000
Sire3:Ration1   0.0000    0.00000
Sire3:Ration2   0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

2.3 p101

(4) MODEL

```
p101 = read.csv("C:/G/Rt/ANOVA/ARS20-8p101.csv")
p101 = af(p101, c("Line", "Sire", "Dam", "Steer"))
GLM(Gain ~ Line + Sire + Dam + Line:Dam + Age + Weight, p101)
```

```
$ANOVA
Response : Gain
                Df Sum Sq  Mean Sq F value    Pr(>F)
MODEL           16 2.4972 0.156073  3.0675 0.001364 **
RESIDUALS       48 2.4422 0.050879
CORRECTED TOTAL 64 4.9394
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
        Df  Sum Sq  Mean Sq F value  Pr(>F)
Line     2 0.38009 0.190046  3.7352 0.03107 *
Sire     6 0.92634 0.154391  3.0345 0.01347 *
Dam      2 0.11894 0.059471  1.1689 0.31940
Line:Dam 4 0.64889 0.162222  3.1884 0.02113 *
Age      1 0.16462 0.164622  3.2356 0.07835 .
Weight   1 0.25828 0.258283  5.0764 0.02886 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
        Df  Sum Sq Mean Sq F value  Pr(>F)
Line     0
Sire     6 0.95299 0.15883  3.1217 0.01155 *
Dam      2 0.32039 0.16019  3.1485 0.05190 .
Line:Dam 4 0.46516 0.11629  2.2856 0.07373 .
Age      1 0.34830 0.34830  6.8456 0.01185 *
Weight   1 0.25828 0.25828  5.0764 0.02886 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
CAUTION: Singularity Exists !
        Df  Sum Sq Mean Sq F value  Pr(>F)
Line     0
Sire     6 0.95299 0.15883  3.1217 0.01155 *
Dam      2 0.12469 0.06234  1.2253 0.30268
Line:Dam 4 0.46516 0.11629  2.2856 0.07373 .
Age      1 0.34830 0.34830  6.8456 0.01185 *
```

```
Weight     1 0.25828 0.25828  5.0764 0.02886 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
             Estimate Std. Error t value  Pr(>|t|)
(Intercept)   2.95068    0.51867  5.6889 7.461e-07 ***
Line1         0.08058    0.14600  0.5519  0.583562
Line2         0.25898    0.13801  1.8765  0.066672 .
Line3         0.00000    0.00000
Sire1         0.07353    0.13054  0.5633  0.575872
Sire2        -0.12448    0.13720 -0.9072  0.368814
Sire3         0.00000    0.00000
Sire4        -0.23837    0.12753 -1.8692  0.067704 .
Sire5         0.00000    0.00000
Sire6         0.10359    0.13013  0.7960  0.429928
Sire7        -0.02129    0.12129 -0.1756  0.861372
Sire8        -0.33135    0.12662 -2.6168  0.011834 *
Sire9         0.00000    0.00000
Dam3          0.36999    0.11530  3.2090  0.002375 **
Dam4          0.27711    0.10444  2.6533  0.010777 *
Dam5          0.00000    0.00000
Line1:Dam3   -0.44415    0.19686 -2.2562  0.028649 *
Line1:Dam4   -0.30365    0.16070 -1.8896  0.064862 .
Line1:Dam5    0.00000    0.00000
Line2:Dam3   -0.26743    0.19635 -1.3620  0.179554
Line2:Dam4   -0.35600    0.17540 -2.0297  0.047954 *
Line2:Dam5    0.00000    0.00000
Line3:Dam3    0.00000    0.00000
Line3:Dam4    0.00000    0.00000
Line3:Dam5    0.00000    0.00000
Age          -0.00815    0.00312 -2.6164  0.011845 *
Weight        0.00197    0.00087  2.2531  0.028860 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

  (5) MODEL

```r
GLM(Gain ~ Sire + Dam + Line:Dam, p101)
```

```
$ANOVA
Response : Gain
                Df Sum Sq  Mean Sq F value   Pr(>F)
MODEL           14 2.0743 0.148162  2.5856 0.006996 **
RESIDUALS       50 2.8651 0.057302
CORRECTED TOTAL 64 4.9394
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
          Df  Sum Sq  Mean Sq F value  Pr(>F)
Sire       8 1.30644 0.163305  2.8499 0.01089 *
Dam        2 0.11894 0.059471  1.0379 0.36172
Dam:Line   4 0.64889 0.162222  2.8310 0.03412 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
          Df  Sum Sq  Mean Sq F value  Pr(>F)
Sire       6 1.06000 0.176667  3.0831 0.01202 *
Dam        2 0.11894 0.059471  1.0379 0.36172
Dam:Line   4 0.64889 0.162222  2.8310 0.03412 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
CAUTION: Singularity Exists !
          Df  Sum Sq  Mean Sq F value  Pr(>F)
Sire       6 1.06000 0.176667  3.0831 0.01202 *
Dam        2 0.02569 0.012844  0.2242 0.79999
Dam:Line   4 0.64889 0.162222  2.8310 0.03412 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)  2.35075    0.09704 24.2246 < 2.2e-16 ***
Sire1        0.20311    0.14084  1.4422  0.155488
Sire2       -0.06287    0.13258 -0.4742  0.637414
Sire3        0.16834    0.15153  1.1109  0.271905
Sire4        0.18107    0.14313  1.2650  0.211718
Sire5        0.31743    0.14313  2.2178  0.031143 *
Sire6       -0.01585    0.13038 -0.1215  0.903749
Sire7       -0.11844    0.12299 -0.9630  0.340164
Sire8       -0.42213    0.13012 -3.2442  0.002102 **
Sire9        0.00000    0.00000
Dam3         0.33813    0.12177  2.7768  0.007706 **
Dam4         0.27529    0.11078  2.4849  0.016348 *
Dam5         0.00000    0.00000
Dam3:Line1  -0.45707    0.20303 -2.2512  0.028796 *
Dam3:Line2  -0.38540    0.20378 -1.8913  0.064384 .
Dam3:Line3   0.00000    0.00000
Dam4:Line1  -0.38180    0.16807 -2.2717  0.027443 *
Dam4:Line2  -0.43029    0.18374 -2.3418  0.023215 *
Dam4:Line3   0.00000    0.00000
```

```
Dam5:Line1    0.00000    0.00000
Dam5:Line2    0.00000    0.00000
Dam5:Line3    0.00000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

3 Snee EMS ANOVA 1974

Reference

- Snee RD. Computation and Use of Expected Mean Squares in Analysis of Variance. J Qual Tech. 1974:6(3);128-137.

(6) MODEL

```
Snee = read.csv("C:/G/Rt/ANOVA/Snee_EMS_ANOVA1974.csv")
Snee = af(Snee, c("Machine", "Analyst", "Test", "Day"))
GLM(Y ~ Day/Machine/Analyst/Test, Snee)
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL          167 751.27  4.4986
RESIDUALS        0   0.00
CORRECTED TOTAL 167 751.27
```

```
$`Type I`
                          Df Sum Sq Mean Sq F value Pr(>F)
Day                       41 365.58  8.9166
Day:Machine               42 196.59  4.6807
Day:Machine:Analyst       42 118.80  2.8285
Day:Machine:Analyst:Test 42  70.31  1.6739
```

```
$`Type II`
                          Df Sum Sq Mean Sq F value Pr(>F)
Day                       41 365.58  8.9166
Day:Machine               42 196.59  4.6807
Day:Machine:Analyst       42 118.80  2.8285
Day:Machine:Analyst:Test 42  70.31  1.6739
```

```
$`Type III`
                          Df Sum Sq Mean Sq F value Pr(>F)
Day                       41 359.44  8.7669
Day:Machine               42 199.40  4.7477
Day:Machine:Analyst       42 118.80  2.8285
Day:Machine:Analyst:Test 42  70.31  1.6739
```

```
$Parameter
                         Estimate Std. Error t value Pr(>|t|)
(Intercept)                  11.3
Day1                         -2.5
Day10                        -2.0
```

```
Day11                          -7.3
Day12                          -1.6
Day13                          -6.7
Day14                          -9.2
Day15                          -1.6
Day16                          -1.3
Day17                          -1.1
Day18                          -2.1
Day19                          -0.5
Day2                           -3.2
Day20                          -1.9
Day21                          -1.0
Day22                          -1.0
Day23                          -3.0
Day24                           0.3
Day25                          -1.9
Day26                           0.0
Day27                           0.1
Day28                          -1.7
Day29                          -9.1
Day3                           -3.9
Day30                          -4.7
Day31                           0.2
Day32                          -2.2
Day33                          -6.7
Day34                          -3.4
Day35                          -2.3
Day36                          -3.2
Day37                          -1.9
Day38                          -0.4
Day39                          -2.3
Day4                           -3.3
Day40                          -3.5
Day41                          -2.0
Day42                          -4.5
Day5                           -1.8
Day6                           -2.1
Day7                            1.5
Day8                           -2.1
Day9                            0.0
Day1:Machine1                  -2.2
Day1:Machine2                   0.0
Day10:Machine1                  1.0
Day10:Machine2                  0.0
Day11:Machine1                  6.0
Day11:Machine2                  0.0
Day12:Machine1                 -0.9
Day12:Machine2                  0.0
```

```
Day13:Machine1          2.1
Day13:Machine2          0.0
Day14:Machine1          6.8
Day14:Machine2          0.0
Day15:Machine1          0.2
Day15:Machine2          0.0
Day16:Machine1         -1.8
Day16:Machine2          0.0
Day17:Machine1         -2.7
Day17:Machine2          0.0
Day18:Machine1         -2.6
Day18:Machine2          0.0
Day19:Machine1         -7.7
Day19:Machine2          0.0
Day2:Machine1           0.1
Day2:Machine2           0.0
Day20:Machine1         -2.2
Day20:Machine2          0.0
Day21:Machine1          0.4
Day21:Machine2          0.0
Day22:Machine1         -1.9
Day22:Machine2          0.0
Day23:Machine1         -0.7
Day23:Machine2          0.0
Day24:Machine1          1.0
Day24:Machine2          0.0
Day25:Machine1          0.2
Day25:Machine2          0.0
Day26:Machine1          1.3
Day26:Machine2          0.0
Day27:Machine1         -0.6
Day27:Machine2          0.0
Day28:Machine1         -4.5
Day28:Machine2          0.0
Day29:Machine1          4.4
Day29:Machine2          0.0
Day3:Machine1           0.6
Day3:Machine2           0.0
Day30:Machine1          2.0
Day30:Machine2          0.0
Day31:Machine1          1.0
Day31:Machine2          0.0
Day32:Machine1          1.3
Day32:Machine2          0.0
Day33:Machine1          6.0
Day33:Machine2          0.0
Day34:Machine1         -0.7
Day34:Machine2          0.0
```

```
Day35:Machine1                      -1.2
Day35:Machine2                       0.0
Day36:Machine1                      -3.7
Day36:Machine2                       0.0
Day37:Machine1                      -0.7
Day37:Machine2                       0.0
Day38:Machine1                       0.3
Day38:Machine2                       0.0
Day39:Machine1                       1.3
Day39:Machine2                       0.0
Day4:Machine1                       -1.5
Day4:Machine2                        0.0
Day40:Machine1                      -0.8
Day40:Machine2                       0.0
Day41:Machine1                      -1.6
Day41:Machine2                       0.0
Day42:Machine1                       0.8
Day42:Machine2                       0.0
Day5:Machine1                       -7.2
Day5:Machine2                        0.0
Day6:Machine1                       -5.2
Day6:Machine2                        0.0
Day7:Machine1                       -1.1
Day7:Machine2                        0.0
Day8:Machine1                       -2.4
Day8:Machine2                        0.0
Day9:Machine1                       -0.8
Day9:Machine2                        0.0
Day1:Machine1:Analyst1               0.0
Day1:Machine1:Analyst2               0.0
Day1:Machine2:Analyst1               0.0
Day1:Machine2:Analyst2               0.0
Day10:Machine1:Analyst1              0.3
Day10:Machine1:Analyst2              0.0
Day10:Machine2:Analyst1              0.0
Day10:Machine2:Analyst2              0.0
Day11:Machine1:Analyst1             -1.6
Day11:Machine1:Analyst2              0.0
Day11:Machine2:Analyst1              0.0
Day11:Machine2:Analyst2              0.0
Day12:Machine1:Analyst1              1.8
Day12:Machine1:Analyst2              0.0
Day12:Machine2:Analyst1              0.0
Day12:Machine2:Analyst2              0.0
Day13:Machine1:Analyst1              0.5
Day13:Machine1:Analyst2              0.0
Day13:Machine2:Analyst1              0.0
Day13:Machine2:Analyst2              0.0
```

```
Day14:Machine1:Analyst1          -0.9
Day14:Machine1:Analyst2           0.0
Day14:Machine2:Analyst1           0.0
Day14:Machine2:Analyst2           0.0
Day15:Machine1:Analyst1          -1.2
Day15:Machine1:Analyst2           0.0
Day15:Machine2:Analyst1           0.0
Day15:Machine2:Analyst2           0.0
Day16:Machine1:Analyst1           0.5
Day16:Machine1:Analyst2           0.0
Day16:Machine2:Analyst1           0.0
Day16:Machine2:Analyst2           0.0
Day17:Machine1:Analyst1          -0.7
Day17:Machine1:Analyst2           0.0
Day17:Machine2:Analyst1           0.0
Day17:Machine2:Analyst2           0.0
Day18:Machine1:Analyst1           0.0
Day18:Machine1:Analyst2           0.0
Day18:Machine2:Analyst1           0.0
Day18:Machine2:Analyst2           0.0
Day19:Machine1:Analyst1           4.0
Day19:Machine1:Analyst2           0.0
Day19:Machine2:Analyst1           0.0
Day19:Machine2:Analyst2           0.0
Day2:Machine1:Analyst1            1.4
Day2:Machine1:Analyst2            0.0
Day2:Machine2:Analyst1            0.0
Day2:Machine2:Analyst2            0.0
Day20:Machine1:Analyst1           2.8
Day20:Machine1:Analyst2           0.0
Day20:Machine2:Analyst1           0.0
Day20:Machine2:Analyst2           0.0
Day21:Machine1:Analyst1          -1.2
Day21:Machine1:Analyst2           0.0
Day21:Machine2:Analyst1           0.0
Day21:Machine2:Analyst2           0.0
Day22:Machine1:Analyst1          -0.7
Day22:Machine1:Analyst2           0.0
Day22:Machine2:Analyst1           0.0
Day22:Machine2:Analyst2           0.0
Day23:Machine1:Analyst1           1.2
Day23:Machine1:Analyst2           0.0
Day23:Machine2:Analyst1           0.0
Day23:Machine2:Analyst2           0.0
Day24:Machine1:Analyst1          -0.4
Day24:Machine1:Analyst2           0.0
Day24:Machine2:Analyst1           0.0
Day24:Machine2:Analyst2           0.0
```

```
Day25:Machine1:Analyst1          0.8
Day25:Machine1:Analyst2          0.0
Day25:Machine2:Analyst1          0.0
Day25:Machine2:Analyst2          0.0
Day26:Machine1:Analyst1         -2.0
Day26:Machine1:Analyst2          0.0
Day26:Machine2:Analyst1          0.0
Day26:Machine2:Analyst2          0.0
Day27:Machine1:Analyst1         -0.2
Day27:Machine1:Analyst2          0.0
Day27:Machine2:Analyst1          0.0
Day27:Machine2:Analyst2          0.0
Day28:Machine1:Analyst1          2.2
Day28:Machine1:Analyst2          0.0
Day28:Machine2:Analyst1          0.0
Day28:Machine2:Analyst2          0.0
Day29:Machine1:Analyst1          0.4
Day29:Machine1:Analyst2          0.0
Day29:Machine2:Analyst1          0.0
Day29:Machine2:Analyst2          0.0
Day3:Machine1:Analyst1          -1.3
Day3:Machine1:Analyst2           0.0
Day3:Machine2:Analyst1           0.0
Day3:Machine2:Analyst2           0.0
Day30:Machine1:Analyst1         -1.6
Day30:Machine1:Analyst2          0.0
Day30:Machine2:Analyst1          0.0
Day30:Machine2:Analyst2          0.0
Day31:Machine1:Analyst1         -3.3
Day31:Machine1:Analyst2          0.0
Day31:Machine2:Analyst1          0.0
Day31:Machine2:Analyst2          0.0
Day32:Machine1:Analyst1          1.3
Day32:Machine1:Analyst2          0.0
Day32:Machine2:Analyst1          0.0
Day32:Machine2:Analyst2          0.0
Day33:Machine1:Analyst1          0.0
Day33:Machine1:Analyst2          0.0
Day33:Machine2:Analyst1          0.0
Day33:Machine2:Analyst2          0.0
Day34:Machine1:Analyst1          3.2
Day34:Machine1:Analyst2          0.0
Day34:Machine2:Analyst1          0.0
Day34:Machine2:Analyst2          0.0
Day35:Machine1:Analyst1          0.6
Day35:Machine1:Analyst2          0.0
Day35:Machine2:Analyst1          0.0
Day35:Machine2:Analyst2          0.0
```

```
Day36:Machine1:Analyst1          2.4
Day36:Machine1:Analyst2          0.0
Day36:Machine2:Analyst1          0.0
Day36:Machine2:Analyst2          0.0
Day37:Machine1:Analyst1          1.4
Day37:Machine1:Analyst2          0.0
Day37:Machine2:Analyst1          0.0
Day37:Machine2:Analyst2          0.0
Day38:Machine1:Analyst1         -0.2
Day38:Machine1:Analyst2          0.0
Day38:Machine2:Analyst1          0.0
Day38:Machine2:Analyst2          0.0
Day39:Machine1:Analyst1         -0.3
Day39:Machine1:Analyst2          0.0
Day39:Machine2:Analyst1          0.0
Day39:Machine2:Analyst2          0.0
Day4:Machine1:Analyst1           0.7
Day4:Machine1:Analyst2           0.0
Day4:Machine2:Analyst1           0.0
Day4:Machine2:Analyst2           0.0
Day40:Machine1:Analyst1          1.0
Day40:Machine1:Analyst2          0.0
Day40:Machine2:Analyst1          0.0
Day40:Machine2:Analyst2          0.0
Day41:Machine1:Analyst1         -0.5
Day41:Machine1:Analyst2          0.0
Day41:Machine2:Analyst1          0.0
Day41:Machine2:Analyst2          0.0
Day42:Machine1:Analyst1          1.2
Day42:Machine1:Analyst2          0.0
Day42:Machine2:Analyst1          0.0
Day42:Machine2:Analyst2          0.0
Day5:Machine1:Analyst1           4.8
Day5:Machine1:Analyst2           0.0
Day5:Machine2:Analyst1           0.0
Day5:Machine2:Analyst2           0.0
Day6:Machine1:Analyst1           5.0
Day6:Machine1:Analyst2           0.0
Day6:Machine2:Analyst1           0.0
Day6:Machine2:Analyst2           0.0
Day7:Machine1:Analyst1          -1.9
Day7:Machine1:Analyst2           0.0
Day7:Machine2:Analyst1           0.0
Day7:Machine2:Analyst2           0.0
Day8:Machine1:Analyst1           1.2
Day8:Machine1:Analyst2           0.0
Day8:Machine2:Analyst1           0.0
Day8:Machine2:Analyst2           0.0
```

```
Day9:Machine1:Analyst1              0.4
Day9:Machine1:Analyst2              0.0
Day9:Machine2:Analyst1              0.0
Day9:Machine2:Analyst2              0.0
Day1:Machine1:Analyst1:Test1       -0.5
Day1:Machine1:Analyst1:Test2        0.0
Day1:Machine1:Analyst2:Test1        0.0
Day1:Machine1:Analyst2:Test2        0.0
Day1:Machine2:Analyst1:Test1        0.0
Day1:Machine2:Analyst1:Test2        0.0
Day1:Machine2:Analyst2:Test1        0.0
Day1:Machine2:Analyst2:Test2        0.0
Day10:Machine1:Analyst1:Test1      -0.9
Day10:Machine1:Analyst1:Test2       0.0
Day10:Machine1:Analyst2:Test1       0.0
Day10:Machine1:Analyst2:Test2       0.0
Day10:Machine2:Analyst1:Test1       0.0
Day10:Machine2:Analyst1:Test2       0.0
Day10:Machine2:Analyst2:Test1       0.0
Day10:Machine2:Analyst2:Test2       0.0
Day11:Machine1:Analyst1:Test1       2.1
Day11:Machine1:Analyst1:Test2       0.0
Day11:Machine1:Analyst2:Test1       0.0
Day11:Machine1:Analyst2:Test2       0.0
Day11:Machine2:Analyst1:Test1       0.0
Day11:Machine2:Analyst1:Test2       0.0
Day11:Machine2:Analyst2:Test1       0.0
Day11:Machine2:Analyst2:Test2       0.0
Day12:Machine1:Analyst1:Test1      -2.3
Day12:Machine1:Analyst1:Test2       0.0
Day12:Machine1:Analyst2:Test1       0.0
Day12:Machine1:Analyst2:Test2       0.0
Day12:Machine2:Analyst1:Test1       0.0
Day12:Machine2:Analyst1:Test2       0.0
Day12:Machine2:Analyst2:Test1       0.0
Day12:Machine2:Analyst2:Test2       0.0
Day13:Machine1:Analyst1:Test1       1.2
Day13:Machine1:Analyst1:Test2       0.0
Day13:Machine1:Analyst2:Test1       0.0
Day13:Machine1:Analyst2:Test2       0.0
Day13:Machine2:Analyst1:Test1       0.0
Day13:Machine2:Analyst1:Test2       0.0
Day13:Machine2:Analyst2:Test1       0.0
Day13:Machine2:Analyst2:Test2       0.0
Day14:Machine1:Analyst1:Test1       2.2
Day14:Machine1:Analyst1:Test2       0.0
Day14:Machine1:Analyst2:Test1       0.0
Day14:Machine1:Analyst2:Test2       0.0
```

```
Day14:Machine2:Analyst1:Test1        0.0
Day14:Machine2:Analyst1:Test2        0.0
Day14:Machine2:Analyst2:Test1        0.0
Day14:Machine2:Analyst2:Test2        0.0
Day15:Machine1:Analyst1:Test1        0.6
Day15:Machine1:Analyst1:Test2        0.0
Day15:Machine1:Analyst2:Test1        0.0
Day15:Machine1:Analyst2:Test2        0.0
Day15:Machine2:Analyst1:Test1        0.0
Day15:Machine2:Analyst1:Test2        0.0
Day15:Machine2:Analyst2:Test1        0.0
Day15:Machine2:Analyst2:Test2        0.0
Day16:Machine1:Analyst1:Test1       -1.6
Day16:Machine1:Analyst1:Test2        0.0
Day16:Machine1:Analyst2:Test1        0.0
Day16:Machine1:Analyst2:Test2        0.0
Day16:Machine2:Analyst1:Test1        0.0
Day16:Machine2:Analyst1:Test2        0.0
Day16:Machine2:Analyst2:Test1        0.0
Day16:Machine2:Analyst2:Test2        0.0
Day17:Machine1:Analyst1:Test1       -1.0
Day17:Machine1:Analyst1:Test2        0.0
Day17:Machine1:Analyst2:Test1        0.0
Day17:Machine1:Analyst2:Test2        0.0
Day17:Machine2:Analyst1:Test1        0.0
Day17:Machine2:Analyst1:Test2        0.0
Day17:Machine2:Analyst2:Test1        0.0
Day17:Machine2:Analyst2:Test2        0.0
Day18:Machine1:Analyst1:Test1        2.3
Day18:Machine1:Analyst1:Test2        0.0
Day18:Machine1:Analyst2:Test1        0.0
Day18:Machine1:Analyst2:Test2        0.0
Day18:Machine2:Analyst1:Test1        0.0
Day18:Machine2:Analyst1:Test2        0.0
Day18:Machine2:Analyst2:Test1        0.0
Day18:Machine2:Analyst2:Test2        0.0
Day19:Machine1:Analyst1:Test1        4.4
Day19:Machine1:Analyst1:Test2        0.0
Day19:Machine1:Analyst2:Test1        0.0
Day19:Machine1:Analyst2:Test2        0.0
Day19:Machine2:Analyst1:Test1        0.0
Day19:Machine2:Analyst1:Test2        0.0
Day19:Machine2:Analyst2:Test1        0.0
Day19:Machine2:Analyst2:Test2        0.0
Day2:Machine1:Analyst1:Test1        -1.1
Day2:Machine1:Analyst1:Test2         0.0
Day2:Machine1:Analyst2:Test1         0.0
Day2:Machine1:Analyst2:Test2         0.0
```

```
Day2:Machine2:Analyst1:Test1        0.0
Day2:Machine2:Analyst1:Test2        0.0
Day2:Machine2:Analyst2:Test1        0.0
Day2:Machine2:Analyst2:Test2        0.0
Day20:Machine1:Analyst1:Test1       0.3
Day20:Machine1:Analyst1:Test2       0.0
Day20:Machine1:Analyst2:Test1       0.0
Day20:Machine1:Analyst2:Test2       0.0
Day20:Machine2:Analyst1:Test1       0.0
Day20:Machine2:Analyst1:Test2       0.0
Day20:Machine2:Analyst2:Test1       0.0
Day20:Machine2:Analyst2:Test2       0.0
Day21:Machine1:Analyst1:Test1      -0.4
Day21:Machine1:Analyst1:Test2       0.0
Day21:Machine1:Analyst2:Test1       0.0
Day21:Machine1:Analyst2:Test2       0.0
Day21:Machine2:Analyst1:Test1       0.0
Day21:Machine2:Analyst1:Test2       0.0
Day21:Machine2:Analyst2:Test1       0.0
Day21:Machine2:Analyst2:Test2       0.0
Day22:Machine1:Analyst1:Test1      -2.0
Day22:Machine1:Analyst1:Test2       0.0
Day22:Machine1:Analyst2:Test1       0.0
Day22:Machine1:Analyst2:Test2       0.0
Day22:Machine2:Analyst1:Test1       0.0
Day22:Machine2:Analyst1:Test2       0.0
Day22:Machine2:Analyst2:Test1       0.0
Day22:Machine2:Analyst2:Test2       0.0
Day23:Machine1:Analyst1:Test1      -0.3
Day23:Machine1:Analyst1:Test2       0.0
Day23:Machine1:Analyst2:Test1       0.0
Day23:Machine1:Analyst2:Test2       0.0
Day23:Machine2:Analyst1:Test1       0.0
Day23:Machine2:Analyst1:Test2       0.0
Day23:Machine2:Analyst2:Test1       0.0
Day23:Machine2:Analyst2:Test2       0.0
Day24:Machine1:Analyst1:Test1      -2.6
Day24:Machine1:Analyst1:Test2       0.0
Day24:Machine1:Analyst2:Test1       0.0
Day24:Machine1:Analyst2:Test2       0.0
Day24:Machine2:Analyst1:Test1       0.0
Day24:Machine2:Analyst1:Test2       0.0
Day24:Machine2:Analyst2:Test1       0.0
Day24:Machine2:Analyst2:Test2       0.0
Day25:Machine1:Analyst1:Test1      -1.0
Day25:Machine1:Analyst1:Test2       0.0
Day25:Machine1:Analyst2:Test1       0.0
Day25:Machine1:Analyst2:Test2       0.0
```

```
Day25:Machine2:Analyst1:Test1      0.0
Day25:Machine2:Analyst1:Test2      0.0
Day25:Machine2:Analyst2:Test1      0.0
Day25:Machine2:Analyst2:Test2      0.0
Day26:Machine1:Analyst1:Test1     -0.3
Day26:Machine1:Analyst1:Test2      0.0
Day26:Machine1:Analyst2:Test1      0.0
Day26:Machine1:Analyst2:Test2      0.0
Day26:Machine2:Analyst1:Test1      0.0
Day26:Machine2:Analyst1:Test2      0.0
Day26:Machine2:Analyst2:Test1      0.0
Day26:Machine2:Analyst2:Test2      0.0
Day27:Machine1:Analyst1:Test1     -3.6
Day27:Machine1:Analyst1:Test2      0.0
Day27:Machine1:Analyst2:Test1      0.0
Day27:Machine1:Analyst2:Test2      0.0
Day27:Machine2:Analyst1:Test1      0.0
Day27:Machine2:Analyst1:Test2      0.0
Day27:Machine2:Analyst2:Test1      0.0
Day27:Machine2:Analyst2:Test2      0.0
Day28:Machine1:Analyst1:Test1      4.2
Day28:Machine1:Analyst1:Test2      0.0
Day28:Machine1:Analyst2:Test1      0.0
Day28:Machine1:Analyst2:Test2      0.0
Day28:Machine2:Analyst1:Test1      0.0
Day28:Machine2:Analyst1:Test2      0.0
Day28:Machine2:Analyst2:Test1      0.0
Day28:Machine2:Analyst2:Test2      0.0
Day29:Machine1:Analyst1:Test1     -1.0
Day29:Machine1:Analyst1:Test2      0.0
Day29:Machine1:Analyst2:Test1      0.0
Day29:Machine1:Analyst2:Test2      0.0
Day29:Machine2:Analyst1:Test1      0.0
Day29:Machine2:Analyst1:Test2      0.0
Day29:Machine2:Analyst2:Test1      0.0
Day29:Machine2:Analyst2:Test2      0.0
Day3:Machine1:Analyst1:Test1       1.9
Day3:Machine1:Analyst1:Test2       0.0
Day3:Machine1:Analyst2:Test1       0.0
Day3:Machine1:Analyst2:Test2       0.0
Day3:Machine2:Analyst1:Test1       0.0
Day3:Machine2:Analyst1:Test2       0.0
Day3:Machine2:Analyst2:Test1       0.0
Day3:Machine2:Analyst2:Test2       0.0
Day30:Machine1:Analyst1:Test1      1.0
Day30:Machine1:Analyst1:Test2      0.0
Day30:Machine1:Analyst2:Test1      0.0
Day30:Machine1:Analyst2:Test2      0.0
```

```
Day30:Machine2:Analyst1:Test1      0.0
Day30:Machine2:Analyst1:Test2      0.0
Day30:Machine2:Analyst2:Test1      0.0
Day30:Machine2:Analyst2:Test2      0.0
Day31:Machine1:Analyst1:Test1      4.2
Day31:Machine1:Analyst1:Test2      0.0
Day31:Machine1:Analyst2:Test1      0.0
Day31:Machine1:Analyst2:Test2      0.0
Day31:Machine2:Analyst1:Test1      0.0
Day31:Machine2:Analyst1:Test2      0.0
Day31:Machine2:Analyst2:Test1      0.0
Day31:Machine2:Analyst2:Test2      0.0
Day32:Machine1:Analyst1:Test1      0.4
Day32:Machine1:Analyst1:Test2      0.0
Day32:Machine1:Analyst2:Test1      0.0
Day32:Machine1:Analyst2:Test2      0.0
Day32:Machine2:Analyst1:Test1      0.0
Day32:Machine2:Analyst1:Test2      0.0
Day32:Machine2:Analyst2:Test1      0.0
Day32:Machine2:Analyst2:Test2      0.0
Day33:Machine1:Analyst1:Test1      3.6
Day33:Machine1:Analyst1:Test2      0.0
Day33:Machine1:Analyst2:Test1      0.0
Day33:Machine1:Analyst2:Test2      0.0
Day33:Machine2:Analyst1:Test1      0.0
Day33:Machine2:Analyst1:Test2      0.0
Day33:Machine2:Analyst2:Test1      0.0
Day33:Machine2:Analyst2:Test2      0.0
Day34:Machine1:Analyst1:Test1     -0.4
Day34:Machine1:Analyst1:Test2      0.0
Day34:Machine1:Analyst2:Test1      0.0
Day34:Machine1:Analyst2:Test2      0.0
Day34:Machine2:Analyst1:Test1      0.0
Day34:Machine2:Analyst1:Test2      0.0
Day34:Machine2:Analyst2:Test1      0.0
Day34:Machine2:Analyst2:Test2      0.0
Day35:Machine1:Analyst1:Test1     -1.9
Day35:Machine1:Analyst1:Test2      0.0
Day35:Machine1:Analyst2:Test1      0.0
Day35:Machine1:Analyst2:Test2      0.0
Day35:Machine2:Analyst1:Test1      0.0
Day35:Machine2:Analyst1:Test2      0.0
Day35:Machine2:Analyst2:Test1      0.0
Day35:Machine2:Analyst2:Test2      0.0
Day36:Machine1:Analyst1:Test1     -0.3
Day36:Machine1:Analyst1:Test2      0.0
Day36:Machine1:Analyst2:Test1      0.0
Day36:Machine1:Analyst2:Test2      0.0
```

```
Day36:Machine2:Analyst1:Test1        0.0
Day36:Machine2:Analyst1:Test2        0.0
Day36:Machine2:Analyst2:Test1        0.0
Day36:Machine2:Analyst2:Test2        0.0
Day37:Machine1:Analyst1:Test1       -0.9
Day37:Machine1:Analyst1:Test2        0.0
Day37:Machine1:Analyst2:Test1        0.0
Day37:Machine1:Analyst2:Test2        0.0
Day37:Machine2:Analyst1:Test1        0.0
Day37:Machine2:Analyst1:Test2        0.0
Day37:Machine2:Analyst2:Test1        0.0
Day37:Machine2:Analyst2:Test2        0.0
Day38:Machine1:Analyst1:Test1        0.0
Day38:Machine1:Analyst1:Test2        0.0
Day38:Machine1:Analyst2:Test1        0.0
Day38:Machine1:Analyst2:Test2        0.0
Day38:Machine2:Analyst1:Test1        0.0
Day38:Machine2:Analyst1:Test2        0.0
Day38:Machine2:Analyst2:Test1        0.0
Day38:Machine2:Analyst2:Test2        0.0
Day39:Machine1:Analyst1:Test1       -1.4
Day39:Machine1:Analyst1:Test2        0.0
Day39:Machine1:Analyst2:Test1        0.0
Day39:Machine1:Analyst2:Test2        0.0
Day39:Machine2:Analyst1:Test1        0.0
Day39:Machine2:Analyst1:Test2        0.0
Day39:Machine2:Analyst2:Test1        0.0
Day39:Machine2:Analyst2:Test2        0.0
Day4:Machine1:Analyst1:Test1         2.1
Day4:Machine1:Analyst1:Test2         0.0
Day4:Machine1:Analyst2:Test1         0.0
Day4:Machine1:Analyst2:Test2         0.0
Day4:Machine2:Analyst1:Test1         0.0
Day4:Machine2:Analyst1:Test2         0.0
Day4:Machine2:Analyst2:Test1         0.0
Day4:Machine2:Analyst2:Test2         0.0
Day40:Machine1:Analyst1:Test1        0.9
Day40:Machine1:Analyst1:Test2        0.0
Day40:Machine1:Analyst2:Test1        0.0
Day40:Machine1:Analyst2:Test2        0.0
Day40:Machine2:Analyst1:Test1        0.0
Day40:Machine2:Analyst1:Test2        0.0
Day40:Machine2:Analyst2:Test1        0.0
Day40:Machine2:Analyst2:Test2        0.0
Day41:Machine1:Analyst1:Test1       -0.6
Day41:Machine1:Analyst1:Test2        0.0
Day41:Machine1:Analyst2:Test1        0.0
Day41:Machine1:Analyst2:Test2        0.0
```

```
Day41:Machine2:Analyst1:Test1      0.0
Day41:Machine2:Analyst1:Test2      0.0
Day41:Machine2:Analyst2:Test1      0.0
Day41:Machine2:Analyst2:Test2      0.0
Day42:Machine1:Analyst1:Test1     -0.4
Day42:Machine1:Analyst1:Test2      0.0
Day42:Machine1:Analyst2:Test1      0.0
Day42:Machine1:Analyst2:Test2      0.0
Day42:Machine2:Analyst1:Test1      0.0
Day42:Machine2:Analyst1:Test2      0.0
Day42:Machine2:Analyst2:Test1      0.0
Day42:Machine2:Analyst2:Test2      0.0
Day5:Machine1:Analyst1:Test1       1.0
Day5:Machine1:Analyst1:Test2       0.0
Day5:Machine1:Analyst2:Test1       0.0
Day5:Machine1:Analyst2:Test2       0.0
Day5:Machine2:Analyst1:Test1       0.0
Day5:Machine2:Analyst1:Test2       0.0
Day5:Machine2:Analyst2:Test1       0.0
Day5:Machine2:Analyst2:Test2       0.0
Day6:Machine1:Analyst1:Test1      -0.5
Day6:Machine1:Analyst1:Test2       0.0
Day6:Machine1:Analyst2:Test1       0.0
Day6:Machine1:Analyst2:Test2       0.0
Day6:Machine2:Analyst1:Test1       0.0
Day6:Machine2:Analyst1:Test2       0.0
Day6:Machine2:Analyst2:Test1       0.0
Day6:Machine2:Analyst2:Test2       0.0
Day7:Machine1:Analyst1:Test1       0.0
Day7:Machine1:Analyst1:Test2       0.0
Day7:Machine1:Analyst2:Test1       0.0
Day7:Machine1:Analyst2:Test2       0.0
Day7:Machine2:Analyst1:Test1       0.0
Day7:Machine2:Analyst1:Test2       0.0
Day7:Machine2:Analyst2:Test1       0.0
Day7:Machine2:Analyst2:Test2       0.0
Day8:Machine1:Analyst1:Test1       1.0
Day8:Machine1:Analyst1:Test2       0.0
Day8:Machine1:Analyst2:Test1       0.0
Day8:Machine1:Analyst2:Test2       0.0
Day8:Machine2:Analyst1:Test1       0.0
Day8:Machine2:Analyst1:Test2       0.0
Day8:Machine2:Analyst2:Test1       0.0
Day8:Machine2:Analyst2:Test2       0.0
Day9:Machine1:Analyst1:Test1       0.1
Day9:Machine1:Analyst1:Test2       0.0
Day9:Machine1:Analyst2:Test1       0.0
Day9:Machine1:Analyst2:Test2       0.0
```

```
Day9:Machine2:Analyst1:Test1        0.0
Day9:Machine2:Analyst1:Test2        0.0
Day9:Machine2:Analyst2:Test1        0.0
Day9:Machine2:Analyst2:Test2        0.0
```

```r
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(Y ~ Day/Machine/Analyst/Test, Snee), type=3, singular.ok=TRUE)
# NOT WORKING
```

4 Goodnight

Reference

- Goodnight JH. The General Linear Models Procedure, Proceedings of the First International SAS User's Group, SAS Institute, Raleigh, N.C. 1976.

4.1 Type I SS

4.1.1 p7

(7) MODEL

```
p7 = read.csv("C:/G/Rt/ANOVA/Goodnight-p7.csv")
p7 = af(p7, c("A", "B"))
GLM(y ~ A + B + A:B, p7)
```

```
$ANOVA
Response : y
                  Df  Sum Sq Mean Sq F value Pr(>F)
MODEL             3 13.6027  4.5342   2.807 0.1721
RESIDUALS         4  6.4613  1.6153
CORRECTED TOTAL   7 20.0639


$`Type I`
    Df  Sum Sq Mean Sq F value  Pr(>F)
A    1 10.8113 10.8113  6.6929 0.06087 .
B    1  1.3122  1.3122  0.8123 0.41839
A:B  1  1.4792  1.4792  0.9157 0.39279
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
    Df  Sum Sq Mean Sq F value  Pr(>F)
A    1 10.8113 10.8113  6.6929 0.06087 .
B    1  1.3122  1.3122  0.8123 0.41839
A:B  1  1.4792  1.4792  0.9157 0.39279
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
    Df  Sum Sq Mean Sq F value  Pr(>F)
A    1 10.8113 10.8113  6.6929 0.06087 .
B    1  1.3122  1.3122  0.8123 0.41839
A:B  1  1.4792  1.4792  0.9157 0.39279
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)    6.610     0.8987  7.3551  0.00182 **
A1            -1.465     1.2710 -1.1527  0.31324
A2             0.000     0.0000
B1             0.050     1.2710  0.0393  0.97050
B2             0.000     0.0000
A1:B1         -1.720     1.7974 -0.9569  0.39279
A1:B2          0.000     0.0000
A2:B1          0.000     0.0000
A2:B2          0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(8) MODEL

```
GLM(y ~ A + A:B + B, p7)
```

```
$ANOVA
Response : y
                 Df  Sum Sq Mean Sq F value Pr(>F)
MODEL            3 13.6027  4.5342   2.807 0.1721
RESIDUALS        4  6.4613  1.6153
CORRECTED TOTAL  7 20.0639


$`Type I`
    Df  Sum Sq Mean Sq F value  Pr(>F)
A    1 10.8113 10.8113  6.6929 0.06087 .
A:B  2  2.7914  1.3957  0.8640 0.48764
B    0
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
    Df  Sum Sq Mean Sq F value  Pr(>F)
A    1 10.8113 10.8113  6.6929 0.06087 .
A:B  1  1.4792  1.4792  0.9157 0.39279
B    1  1.3122  1.3122  0.8123 0.41839
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
    Df  Sum Sq Mean Sq F value  Pr(>F)
A    1 10.8113 10.8113  6.6929 0.06087 .
A:B  1  1.4792  1.4792  0.9157 0.39279
```

```
B    1  1.3122  1.3122  0.8123 0.41839
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)    6.610      0.8987  7.3551  0.00182 **
A1            -1.465      1.2710 -1.1527  0.31324
A2             0.000      0.0000
A1:B1         -1.670      1.2710 -1.3140  0.25914
A1:B2          0.000      0.0000
A2:B1          0.050      1.2710  0.0393  0.97050
A2:B2          0.000      0.0000
B1             0.000      0.0000
B2             0.000      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

  (9) MODEL

```
GLM(y ~ B + A + A:B, p7)
```


```
$ANOVA
Response : y
                 Df  Sum Sq Mean Sq F value Pr(>F)
MODEL             3 13.6027  4.5342   2.807 0.1721
RESIDUALS         4  6.4613  1.6153
CORRECTED TOTAL   7 20.0639


$`Type I`
    Df  Sum Sq Mean Sq F value  Pr(>F)
B    1  1.3122  1.3122  0.8123 0.41839
A    1 10.8113 10.8113  6.6929 0.06087 .
B:A  1  1.4792  1.4792  0.9157 0.39279
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
    Df  Sum Sq Mean Sq F value  Pr(>F)
B    1  1.3122  1.3122  0.8123 0.41839
A    1 10.8113 10.8113  6.6929 0.06087 .
B:A  1  1.4792  1.4792  0.9157 0.39279
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
    Df  Sum Sq Mean Sq F value  Pr(>F)
```

```
B    1  1.3122  1.3122  0.8123 0.41839
A    1 10.8113 10.8113  6.6929 0.06087 .
B:A  1  1.4792  1.4792  0.9157 0.39279
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)    6.610     0.8987  7.3551  0.00182 **
B1             0.050     1.2710  0.0393  0.97050
B2             0.000     0.0000
A1            -1.465     1.2710 -1.1527  0.31324
A2             0.000     0.0000
B1:A1         -1.720     1.7974 -0.9569  0.39279
B1:A2          0.000     0.0000
B2:A1          0.000     0.0000
B2:A2          0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

 (10) MODEL

```
GLM(y ~ B + A:B + A, p7)
```

```
$ANOVA
Response : y
                Df  Sum Sq Mean Sq F value Pr(>F)
MODEL            3 13.6027  4.5342   2.807 0.1721
RESIDUALS        4  6.4613  1.6153
CORRECTED TOTAL  7 20.0639


$`Type I`
    Df  Sum Sq Mean Sq F value Pr(>F)
B    1  1.3122  1.3122  0.8123 0.4184
B:A  2 12.2905  6.1452  3.8043 0.1187
A    0


$`Type II`
    Df  Sum Sq Mean Sq F value  Pr(>F)
B    1  1.3122  1.3122  0.8123 0.41839
B:A  1  1.4792  1.4792  0.9157 0.39279
A    1 10.8113 10.8113  6.6929 0.06087 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
    Df  Sum Sq Mean Sq F value  Pr(>F)
```

```
B    1  1.3122  1.3122   0.8123 0.41839
B:A  1  1.4792  1.4792   0.9157 0.39279
A    1 10.8113 10.8113   6.6929 0.06087 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)    6.610     0.8987  7.3551  0.00182 **
B1             0.050     1.2710  0.0393  0.97050
B2             0.000     0.0000
B1:A1         -3.185     1.2710 -2.5060  0.06634 .
B1:A2          0.000     0.0000
B2:A1         -1.465     1.2710 -1.1527  0.31324
B2:A2          0.000     0.0000
A1             0.000     0.0000
A2             0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


 (11) MODEL
```

```
GLM(y ~ A:B + A + B, p7)
```

```
$ANOVA
Response : y
                 Df  Sum Sq Mean Sq F value Pr(>F)
MODEL            3 13.6027   4.5342   2.807 0.1721
RESIDUALS        4  6.4613   1.6153
CORRECTED TOTAL  7 20.0639


$`Type I`
    Df Sum Sq Mean Sq F value Pr(>F)
A:B  3 13.603   4.5342   2.807 0.1721
A    0
B    0


$`Type II`
    Df  Sum Sq Mean Sq F value  Pr(>F)
A:B  1  1.4792  1.4792  0.9157 0.39279
A    1 10.8113 10.8113  6.6929 0.06087 .
B    1  1.3122  1.3122  0.8123 0.41839
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
    Df  Sum Sq Mean Sq F value  Pr(>F)
```

```
A:B  1  1.4792  1.4792  0.9157 0.39279
A    1 10.8113 10.8113  6.6929 0.06087 .
B    1  1.3122  1.3122  0.8123 0.41839
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)    6.610     0.8987  7.3551  0.00182 **
A1:B1         -3.135     1.2710 -2.4667  0.06920 .
A1:B2         -1.465     1.2710 -1.1527  0.31324
A2:B1          0.050     1.2710  0.0393  0.97050
A2:B2          0.000     0.0000
A1             0.000     0.0000
A2             0.000     0.0000
B1             0.000     0.0000
B2             0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

 (12) MODEL

```
GLM(y ~ A:B + A + B, p7)
```

```
$ANOVA
Response : y
                 Df  Sum Sq Mean Sq F value Pr(>F)
MODEL             3 13.6027  4.5342   2.807 0.1721
RESIDUALS         4  6.4613  1.6153
CORRECTED TOTAL   7 20.0639


$`Type I`
    Df Sum Sq Mean Sq F value Pr(>F)
A:B  3 13.603  4.5342   2.807 0.1721
A    0
B    0


$`Type II`
    Df  Sum Sq Mean Sq F value  Pr(>F)
A:B  1  1.4792  1.4792  0.9157 0.39279
A    1 10.8113 10.8113  6.6929 0.06087 .
B    1  1.3122  1.3122  0.8123 0.41839
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
    Df  Sum Sq Mean Sq F value  Pr(>F)
```

32

```
A:B   1   1.4792   1.4792   0.9157 0.39279
A     1  10.8113  10.8113   6.6929 0.06087 .
B     1   1.3122   1.3122   0.8123 0.41839
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)    6.610     0.8987  7.3551  0.00182 **
A1:B1         -3.135     1.2710 -2.4667  0.06920 .
A1:B2         -1.465     1.2710 -1.1527  0.31324
A2:B1          0.050     1.2710  0.0393  0.97050
A2:B2          0.000     0.0000
A1             0.000     0.0000
A2             0.000     0.0000
B1             0.000     0.0000
B2             0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

4.2   Type II SS

4.2.1   p14

(13) MODEL

```
GLM(y ~ A + B + A:B, p7[-8,]) # p16
```

```
$ANOVA
Response : y
                 Df  Sum Sq Mean Sq F value Pr(>F)
MODEL            3 12.7672  4.2557  2.0088 0.2906
RESIDUALS        3  6.3555  2.1185
CORRECTED TOTAL  6 19.1227

$`Type I`
    Df Sum Sq Mean Sq F value Pr(>F)
A    1 9.9567  9.9567  4.6999 0.1187
B    1 1.9225  1.9225  0.9075 0.4111
A:B  1 0.8880  0.8880  0.4192 0.5635

$`Type II`
    Df  Sum Sq Mean Sq F value Pr(>F)
A    1 11.1715 11.1715  5.2733 0.1053
B    1  1.9225  1.9225  0.9075 0.4111
A:B  1  0.8880  0.8880  0.4192 0.5635
```

```
$`Type III`
    Df Sum Sq Mean Sq F value Pr(>F)
A    1 9.5258  9.5258  4.4965 0.1241
B    1 1.3690  1.3690  0.6462 0.4803
A:B  1 0.8880  0.8880  0.4192 0.5635


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   6.840     1.4555  4.6994  0.01823 *
A1           -1.695     1.7826 -0.9508  0.41183
A2            0.000     0.0000
B1           -0.180     1.7826 -0.1010  0.92594
B2            0.000     0.0000
A1:B1        -1.490     2.3014 -0.6474  0.56347
A1:B2         0.000     0.0000
A2:B1         0.000     0.0000
A2:B2         0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

4.2.2 p24

(14) MODEL

```r
p24 = read.csv("C:/G/Rt/ANOVA/Goodnight-p24.csv")
p24 = af(p24, c("A", "B", "C"))
GLM(Y ~ A + B + C, p24) # p27
```

```
$ANOVA
Response : Y
               Df Sum Sq Mean Sq F value  Pr(>F)
MODEL           6 45.924  7.6540  9.1615 0.00499 **
RESIDUALS       7  5.848  0.8354
CORRECTED TOTAL 13 51.772
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
  Df Sum Sq Mean Sq F value  Pr(>F)
A  1  4.724  4.7235  5.6538 0.04904 *
B  3 37.998 12.6660 15.1606 0.00191 **
C  2  3.203  1.6013  1.9167 0.21686
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

34

```
$`Type II`
  Df Sum Sq Mean Sq F value Pr(>F)
A  0
B  2 0.4424  0.2212  0.2648 0.7747
C  2 3.2025  1.6013  1.9167 0.2169

$`Type III`
CAUTION: Singularity Exists !
  Df Sum Sq Mean Sq F value Pr(>F)
A  0
B  2 0.4424  0.2212  0.2648 0.7747
C  2 3.2026  1.6013  1.9167 0.2169

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   10.290    1.11945  9.1920 3.718e-05 ***
A1            -2.305    0.91403 -2.5218   0.03971 *
A2             0.000    0.00000
B1            -6.450    2.23891 -2.8809   0.02362 *
B2            -4.080    1.29263 -3.1563   0.01601 *
B3            -1.610    0.91403 -1.7614   0.12155
B4             0.000    0.00000
C1             1.065    2.23891  0.4757   0.64879
C2             1.760    1.29263  1.3616   0.21553
C3             0.000    0.00000
C4             0.000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

4.3 Type III SS

4.3.1 p27

(15) MODEL

```
p27 = read.csv("C:/G/Rt/ANOVA/Goodnight-p27.csv")
p27 = af(p27, c("A", "B"))
GLM(y ~ A + B + A:B, p27) # p29
```

```
$ANOVA
Response : y
                 Df  Sum Sq Mean Sq F value   Pr(>F)
MODEL            5 128.193 25.6386  53.469 6.77e-05 ***
RESIDUALS        6   2.877  0.4795
CORRECTED TOTAL 11 131.070
---
```

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
    Df Sum Sq Mean Sq F value   Pr(>F)
A   2 89.580 44.790 93.4102 3.013e-05 ***
B   2 38.542 19.271 40.1901 0.0003351 ***
A:B 1 0.071   0.071 0.1471 0.7145464

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
    Df Sum Sq Mean Sq F value   Pr(>F)
A   2 126.778 63.389 132.1977 1.093e-05 ***
B   2 38.542 19.271 40.1901 0.0003351 ***
A:B 1   0.071   0.071   0.1471 0.7145464

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
    Df Sum Sq Mean Sq F value   Pr(>F)
A   2 126.778 63.389 132.1977 1.093e-05 ***
B   2 38.542 19.271 40.1901 0.0003351 ***
A:B 1   0.071   0.071   0.1471 0.7145464

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   16.270   0.84809 19.1844 1.298e-06 ***
A1   -8.870   0.97929 -9.0576 0.0001015 ***
A2   -4.915   0.69246 -7.0979 0.0003927 ***
A3   0.000   0.00000
B1   -4.900   0.69246 -7.0762 0.0003993 ***
B2   -1.875   0.97929 -1.9147 0.1040334
B3   0.000   0.00000
A1:B1   0.000   0.00000
A1:B2   -0.460   1.19937 -0.3835 0.7145464
A1:B3   0.000   0.00000
A2:B1   0.000   0.00000
A2:B2   0.000   0.00000
A2:B3   0.000   0.00000
A3:B1   0.000   0.00000
A3:B2   0.000   0.00000
A3:B3   0.000   0.00000

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

4.3.2 p33

(16) MODEL

```
p33 = read.csv("C:/G/Rt/ANOVA/Goodnight-p33.csv")
p33 = af(p33, c("A", "B"))
GLM(y ~ A + B + A:B, p33) # p35
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL            4 34.905  8.7261
RESIDUALS        0  0.000
CORRECTED TOTAL  4 34.905


$`Type I`
    Df  Sum Sq Mean Sq F value Pr(>F)
A    2 11.3739  5.6870
B    1 23.5225 23.5225
A:B  1  0.0081  0.0081


$`Type II`
    Df  Sum Sq Mean Sq F value Pr(>F)
A    1  3.0276  3.0276
B    1 23.5225 23.5225
A:B  1  0.0081  0.0081


$`Type III`
CAUTION: Singularity Exists !
    Df  Sum Sq Mean Sq F value Pr(>F)
A    1  3.0276  3.0276
B    1 23.5225 23.5225
A:B  1  0.0081  0.0081


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)     9.53
A1             -1.63
A2              0.02
A3              0.00
B1             -4.76
B2              0.00
B3              0.00
A1:B1          -0.18
A1:B2           0.00
A1:B3           0.00
A2:B1           0.00
```

```
A2:B2            0.00
A2:B3            0.00
A3:B1            0.00
A3:B2            0.00
A3:B3            0.00
```

```r
options(contrasts = c("contr.sum", "contr.poly"))
Anova(lm(y ~ A + B + A:B, p33), type=3, singular.ok=TRUE) # NOT WORKING
```

5 SAS for Linear Models 4e

Reference

- Littell RC, Stroup WW, Freund RJ. SAS for Linear Models 4e. John Wiley & Sons Inc. 2002.

5.1 Chapter 2

5.1.1 p5

(17) MODEL

```
p5 = read.table("C:/G/Rt/SAS4lm/p5.txt", head=TRUE)
GLM(COST ~ CATTLE, p5) # p6 Output 2.2
```

```
$ANOVA
Response : COST
                Df Sum Sq Mean Sq F value     Pr(>F)
MODEL            1 6582.1  6582.1   59.34 6.083e-07 ***
RESIDUALS       17 1885.7   110.9
CORRECTED TOTAL 18 8467.8
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
       Df Sum Sq Mean Sq F value     Pr(>F)
CATTLE  1 6582.1  6582.1   59.34 6.083e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
       Df Sum Sq Mean Sq F value     Pr(>F)
CATTLE  1 6582.1  6582.1   59.34 6.083e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
       Df Sum Sq Mean Sq F value     Pr(>F)
CATTLE  1 6582.1  6582.1   59.34 6.083e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   7.1965     4.3751  1.6449    0.1184
CATTLE        4.5640     0.5925  7.7032 6.083e-07 ***
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.1.2 p12

(18) MODEL

```
p12 = read.table("C:/G/Rt/SAS4lm/p12.txt", head=TRUE)
GLM(COST ~ CATTLE + CALVES + HOGS + SHEEP, p12)
```

```
$ANOVA
Response : COST
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            4 7936.7 1984.18   52.31 2.885e-08 ***
RESIDUALS       14  531.0   37.93
CORRECTED TOTAL 18 8467.8
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
       Df Sum Sq Mean Sq  F value     Pr(>F)
CATTLE  1 6582.1  6582.1 173.5265 2.801e-09 ***
CALVES  1  186.7   186.7   4.9213 0.0435698 *
HOGS    1  489.9   489.9  12.9145 0.0029351 **
SHEEP   1  678.1   678.1  17.8773 0.0008431 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
       Df  Sum Sq Mean Sq F value    Pr(>F)
CATTLE  1 2200.71 2200.71 58.0183 2.413e-06 ***
CALVES  1  136.08  136.08  3.5876 0.0790616 .
HOGS    1  113.66  113.66  2.9964 0.1054198
SHEEP   1  678.11  678.11 17.8773 0.0008431 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
       Df  Sum Sq Mean Sq F value    Pr(>F)
CATTLE  1 2200.71 2200.71 58.0183 2.413e-06 ***
CALVES  1  136.08  136.08  3.5876 0.0790616 .
HOGS    1  113.66  113.66  2.9964 0.1054198
SHEEP   1  678.11  678.11 17.8773 0.0008431 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
             Estimate Std. Error t value  Pr(>|t|)
(Intercept)    2.2884     3.3874  0.6756 0.5103160
CATTLE         3.2155     0.4222  7.6170 2.413e-06 ***
CALVES         1.6131     0.8517  1.8941 0.0790616 .
HOGS           0.8148     0.4707  1.7310 0.1054198
SHEEP          0.8026     0.1898  4.2282 0.0008431 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(19) MODEL

```
GLM(COST ~ CATTLE + CALVES + SHEEP, p12)
```

```
$ANOVA
Response : COST
                 Df Sum Sq Mean Sq F value     Pr(>F)
MODEL             3 7823.1 2607.69  60.673 1.281e-08 ***
RESIDUALS        15  644.7    42.98
CORRECTED TOTAL  18 8467.8
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
       Df Sum Sq Mean Sq  F value     Pr(>F)
CATTLE  1 6582.1  6582.1 153.1443 2.835e-09 ***
CALVES  1  186.7   186.7   4.3432 0.0546701 .
SHEEP   1 1054.3  1054.3  24.5306 0.0001735 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
       Df Sum Sq Mean Sq F value     Pr(>F)
CATTLE  1 2519.8  2519.8 58.6265 1.471e-06 ***
CALVES  1  260.6   260.6  6.0634 0.0263909 *
SHEEP   1 1054.3  1054.3 24.5306 0.0001735 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
       Df Sum Sq Mean Sq F value     Pr(>F)
CATTLE  1 2519.8  2519.8 58.6265 1.471e-06 ***
CALVES  1  260.6   260.6  6.0634 0.0263909 *
SHEEP   1 1054.3  1054.3 24.5306 0.0001735 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   1.0709     3.5272  0.3036 0.7655951
CATTLE        3.3665     0.4397  7.6568 1.471e-06 ***
CALVES        2.1046     0.8547  2.4624 0.0263909 *
SHEEP         0.9267     0.1871  4.9528 0.0001735 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

 (20) MODEL

```
GLM(COST ~ CATTLE + CALVES + offset(1*HOGS) + SHEEP, p12)
```

```
$ANOVA
Response : COST
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            3 7823.1 2607.69  60.673 1.281e-08 ***
RESIDUALS       15  644.7   42.98
CORRECTED TOTAL 18 8467.8
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
       Df Sum Sq Mean Sq  F value    Pr(>F)
CATTLE  1 6582.1  6582.1 153.1443 2.835e-09 ***
CALVES  1  186.7   186.7   4.3432 0.0546701 .
SHEEP   1 1054.3  1054.3  24.5306 0.0001735 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
       Df Sum Sq Mean Sq F value    Pr(>F)
CATTLE  1 2519.8  2519.8 58.6265 1.471e-06 ***
CALVES  1  260.6   260.6  6.0634 0.0263909 *
SHEEP   1 1054.3  1054.3 24.5306 0.0001735 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
       Df Sum Sq Mean Sq F value    Pr(>F)
CATTLE  1 2519.8  2519.8 58.6265 1.471e-06 ***
CALVES  1  260.6   260.6  6.0634 0.0263909 *
SHEEP   1 1054.3  1054.3 24.5306 0.0001735 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
```

```
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   1.0709      3.5272  0.3036 0.7655951
CATTLE        3.3665      0.4397  7.6568 1.471e-06 ***
CALVES        2.1046      0.8547  2.4624 0.0263909 *
SHEEP         0.9267      0.1871  4.9528 0.0001735 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

 (21) MODEL

```
GLM(COST ~ CATTLE + CALVES + I(HOGS + SHEEP), p12)
```

```
$ANOVA
Response : COST
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            3 7936.7  2645.6  74.726 3.011e-09 ***
RESIDUALS       15  531.1    35.4
CORRECTED TOTAL 18 8467.8
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
                Df Sum Sq Mean Sq  F value     Pr(>F)
CATTLE           1 6582.1  6582.1 185.9151 7.406e-10 ***
CALVES           1  186.7   186.7   5.2726   0.03649 *
I(HOGS + SHEEP)  1 1168.0  1168.0  32.9896 3.883e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
                Df  Sum Sq Mean Sq F value    Pr(>F)
CATTLE           1 2215.48 2215.48 62.5775 9.887e-07 ***
CALVES           1  155.03  155.03  4.3788    0.0538 .
I(HOGS + SHEEP)  1 1167.96 1167.96 32.9896 3.883e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
                Df  Sum Sq Mean Sq F value    Pr(>F)
CATTLE           1 2215.48 2215.48 62.5775 9.887e-07 ***
CALVES           1  155.03  155.03  4.3788    0.0538 .
I(HOGS + SHEEP)  1 1167.96 1167.96 32.9896 3.883e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
                Estimate Std. Error t value  Pr(>|t|)
```

```
(Intercept)        2.2721    3.1899  0.7123    0.4872
CATTLE             3.2162    0.4066  7.9106 9.887e-07 ***
CALVES             1.6194    0.7739  2.0926    0.0538 .
I(HOGS + SHEEP)    0.8052    0.1402  5.7437 3.883e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

 (22) MODEL

```
REG(COST ~ CATTLE + CALVES + I(HOGS + SHEEP), p12, NOINT=TRUE)
```

```
                Estimate Std. Error t value  Pr(>|t|)
CATTLE            3.3000    0.38314  8.6131 2.100e-07 ***
CALVES            1.9672    0.59108  3.3281  0.004259 **
I(HOGS + SHEEP)   0.8068    0.13800  5.8466 2.479e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.2   Chapter 3

5.2.1   p63

 (23) MODEL

```
p63w = read.table("C:/G/Rt/SAS4lm/p63.txt", header=TRUE)
p63l = reshape(p63w,
        direction = "long",
        varying = list(names(p63w)[2:9]),
        v.names = "fruitwt",
        idvar = c("irrig"),
        timevar = "bloc",
        times = 1:8)
p63l = af(p63l, c("bloc"))
GLM(fruitwt ~ bloc + irrig, p63l) # p64
```

```
$ANOVA
Response : fruitwt
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           11 445334   40485   12.04 6.643e-08 ***
RESIDUALS       28  94147    3362
CORRECTED TOTAL 39 539481
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
```

```
       Df Sum Sq Mean Sq F value    Pr(>F)
bloc   7 401308   57330 17.0503 1.452e-08 ***
irrig  4  44026   11006  3.2734   0.02539 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
       Df Sum Sq Mean Sq F value    Pr(>F)
bloc   7 401308   57330 17.0503 1.452e-08 ***
irrig  4  44026   11006  3.2734   0.02539 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
       Df Sum Sq Mean Sq F value    Pr(>F)
bloc   7 401308   57330 17.0503 1.452e-08 ***
irrig  4  44026   11006  3.2734   0.02539 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
              Estimate Std. Error t value  Pr(>|t|)
(Intercept)    220.150     31.760  6.9316 1.553e-07 ***
bloc1          152.600     36.674  4.1610 0.0002725 ***
bloc2          249.600     36.674  6.8060 2.155e-07 ***
bloc3           83.400     36.674  2.2741 0.0308206 *
bloc4         -112.000     36.674 -3.0540 0.0049132 **
bloc5          115.400     36.674  3.1467 0.0038956 **
bloc6          101.800     36.674  2.7758 0.0097029 **
bloc7           45.000     36.674  1.2270 0.2300251
bloc8            0.000      0.000
irrigbasin      -9.250     28.993 -0.3190 0.7520625
irrigflood     -70.000     28.993 -2.4144 0.0225461 *
irrigspray     -75.875     28.993 -2.6170 0.0141421 *
irrigsprnkler   -7.625     28.993 -0.2630 0.7944806
irrigtrickle     0.000      0.000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.2.2 p72

(24) MODEL

```r
p72 = read.table("C:/G/Rt/SAS4lm/p72.txt", header=TRUE)
p72 = af(p72, c("run", "pos", "mat"))
GLM(wtloss ~ run + pos + mat, p72) # p73
```

```
$ANOVA
Response : wtloss
                Df Sum Sq Mean Sq F value   Pr(>F)
MODEL            9 7076.5  786.28  12.837 0.002828 **
RESIDUALS        6  367.5   61.25
CORRECTED TOTAL 15 7444.0
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
    Df Sum Sq Mean Sq F value    Pr(>F)
run  3  986.5  328.83  5.3687 0.0390130 *
pos  3 1468.5  489.50  7.9918 0.0161685 *
mat  3 4621.5 1540.50 25.1510 0.0008498 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
    Df Sum Sq Mean Sq F value    Pr(>F)
run  3  986.5  328.83  5.3687 0.0390130 *
pos  3 1468.5  489.50  7.9918 0.0161685 *
mat  3 4621.5 1540.50 25.1510 0.0008498 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
    Df Sum Sq Mean Sq F value    Pr(>F)
run  3  986.5  328.83  5.3687 0.0390130 *
pos  3 1468.5  489.50  7.9918 0.0161685 *
mat  3 4621.5 1540.50 25.1510 0.0008498 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   210.25     6.1872 33.9815 4.325e-08 ***
run1            9.25     5.5340  1.6715 0.1456579
run2            7.00     5.5340  1.2649 0.2528101
run3           21.75     5.5340  3.9303 0.0077104 **
run4            0.00     0.0000
pos1            8.50     5.5340  1.5360 0.1754542
pos2           26.25     5.5340  4.7434 0.0031802 **
pos3            8.25     5.5340  1.4908 0.1866076
pos4            0.00     0.0000
matA           35.25     5.5340  6.3697 0.0007032 ***
matB          -10.50     5.5340 -1.8974 0.1065582
matC           11.25     5.5340  2.0329 0.0883093 .
matD            0.00     0.0000
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
GLM(shrink ~ run + pos + mat, p72) # p73
```

```
$ANOVA
Response : shrink
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            9 265.75  29.528  9.8426 0.005775 **
RESIDUALS        6  18.00   3.000
CORRECTED TOTAL 15 283.75
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
    Df Sum Sq Mean Sq F value    Pr(>F)
run  3  33.25  11.083  3.6944 0.081254 .
pos  3  60.25  20.083  6.6944 0.024212 *
mat  3 172.25  57.417 19.1389 0.001786 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
    Df Sum Sq Mean Sq F value    Pr(>F)
run  3  33.25  11.083  3.6944 0.081254 .
pos  3  60.25  20.083  6.6944 0.024212 *
mat  3 172.25  57.417 19.1389 0.001786 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
    Df Sum Sq Mean Sq F value    Pr(>F)
run  3  33.25  11.083  3.6944 0.081254 .
pos  3  60.25  20.083  6.6944 0.024212 *
mat  3 172.25  57.417 19.1389 0.001786 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)    41.75     1.3693 30.4899 8.261e-08 ***
run1            0.50     1.2247  0.4082  0.697261
run2            1.25     1.2247  1.0206  0.346810
run3            3.75     1.2247  3.0619  0.022172 *
run4            0.00     0.0000
pos1            2.75     1.2247  2.2454  0.065859 .
pos2            5.00     1.2247  4.0825  0.006484 **
```

```
pos3            0.75      1.2247   0.6124   0.562764
pos4            0.00      0.0000
matA            6.75      1.2247   5.5114   0.001499 **
matB           -2.00      1.2247  -1.6330   0.153590
matC            2.75      1.2247   2.2454   0.065859 .
matD            0.00      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.2.3 p75

(25) MODEL

```
p75w = read.table("C:/G/Rt/SAS4lm/p75.txt", header=TRUE)
p75l = reshape(p75w,
        direction = "long",
        varying = list(names(p75w)[4:9]),
        v.names = "Y",
        idvar = c("method", "variety", "trt"),
        timevar = "yield",
        times = 1:6)
p75l = af(p75l, c("variety", "yield"))
GLM(Y ~ method*variety, p75l) # p78
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           14 1339.0  95.645  4.8674 2.723e-06 ***
RESIDUALS       75 1473.8  19.650
CORRECTED TOTAL 89 2812.8
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
                Df Sum Sq Mean Sq F value    Pr(>F)
method           2 953.16  476.58 24.2531 7.525e-09 ***
variety          4  11.38    2.85  0.1448   0.96476
method:variety   8 374.49   46.81  2.3822   0.02409 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
                Df Sum Sq Mean Sq F value    Pr(>F)
method           2 953.16  476.58 24.2531 7.525e-09 ***
variety          4  11.38    2.85  0.1448   0.96476
method:variety   8 374.49   46.81  2.3822   0.02409 *
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
              Df Sum Sq Mean Sq F value    Pr(>F)
method         2 953.16  476.58 24.2531 7.525e-09 ***
variety        4  11.38    2.85  0.1448   0.96476
method:variety 8 374.49   46.81  2.3822   0.02409 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
                  Estimate Std. Error t value  Pr(>|t|)
(Intercept)        12.5500     1.8097  6.9348  1.23e-09 ***
methoda             9.7833     2.5593  3.8226 0.0002707 ***
methodb             6.6667     2.5593  2.6049 0.0110772 *
methodc             0.0000     0.0000
variety1            5.8667     2.5593  2.2923 0.0246955 *
variety2            7.3667     2.5593  2.8784 0.0052049 **
variety3            4.7667     2.5593  1.8625 0.0664519 .
variety4            2.2833     2.5593  0.8922 0.3751569
variety5            0.0000     0.0000
methoda:variety1   -6.4333     3.6194 -1.7775 0.0795479 .
methoda:variety2   -7.8500     3.6194 -2.1689 0.0332634 *
methoda:variety3   -3.9667     3.6194 -1.0959 0.2766108
methoda:variety4    1.3500     3.6194  0.3730 0.7102090
methoda:variety5    0.0000     0.0000
methodb:variety1  -10.0000     3.6194 -2.7629 0.0072031 **
methodb:variety2  -11.3500     3.6194 -3.1359 0.0024473 **
methodb:variety3   -8.5333     3.6194 -2.3577 0.0210000 *
methodb:variety4   -8.0000     3.6194 -2.2103 0.0301340 *
methodb:variety5    0.0000     0.0000
methodc:variety1    0.0000     0.0000
methodc:variety2    0.0000     0.0000
methodc:variety3    0.0000     0.0000
methodc:variety4    0.0000     0.0000
methodc:variety5    0.0000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.3 Chapter 4

5.3.1 p94

 (26) MODEL

```
p94w = read.table("C:/G/Rt/SAS4lm/p94.txt", head=TRUE)
p94l = reshape(p94w,
        direction = "long",
        varying = list(names(p94w)[3:8]),
        v.names = "ct",
        idvar = c("package"),
        timevar = "sample",
        times = 1:6)
p94l$sampleA = floor((p94l$sample + 1)/2)
p94l$sampleB = 2 - (p94l$sample) %% 2
p94l$logct = log10(p94l$ct)
p94l = af(p94l, c("sample", "sampleA", "sampleB", "package"))
GLM(logct ~ package + sampleA %in% package, p94l) # p97
```

```
$ANOVA
Response : logct
                 Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            59 50.463 0.85531  22.229 < 2.2e-16 ***
RESIDUALS        60  2.309 0.03848
CORRECTED TOTAL 119 52.772
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
                Df Sum Sq Mean Sq F value    Pr(>F)
package         19 30.529 1.60680  41.760 < 2.2e-16 ***
package:sampleA 40 19.934 0.49836  12.952 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
                Df Sum Sq Mean Sq F value    Pr(>F)
package         19 30.529 1.60680  41.760 < 2.2e-16 ***
package:sampleA 40 19.934 0.49836  12.952 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
                Df Sum Sq Mean Sq F value    Pr(>F)
package         19 30.529 1.60680  41.760 < 2.2e-16 ***
package:sampleA 40 19.934 0.49836  12.952 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
                Estimate Std. Error t value  Pr(>|t|)
(Intercept)      3.02560    0.13870 21.8135 < 2.2e-16 ***
```

```
package1            0.31817    0.19616   1.6220 0.1100424
package10          -0.70207    0.19616  -3.5791 0.0006900 ***
package11           0.03927    0.19616   0.2002 0.8420172
package12           0.17644    0.19616   0.8995 0.3719839
package13           0.24985    0.19616   1.2737 0.2076669
package14          -0.50666    0.19616  -2.5829 0.0122522 *
package15          -0.38616    0.19616  -1.9686 0.0536211 .
package16           1.06635    0.19616   5.4362 1.049e-06 ***
package17          -0.05000    0.19616  -0.2549 0.7996621
package18          -0.45347    0.19616  -2.3118 0.0242394 *
package19           0.92320    0.19616   4.7065 1.530e-05 ***
package2           -0.39384    0.19616  -2.0078 0.0491774 *
package20           1.01238    0.19616   5.1611 2.924e-06 ***
package3            0.20244    0.19616   1.0321 0.3061898
package4            0.60840    0.19616   3.1016 0.0029318 **
package5           -0.36644    0.19616  -1.8681 0.0666346 .
package6           -0.65494    0.19616  -3.3389 0.0014498 **
package7            0.75615    0.19616   3.8548 0.0002847 ***
package8           -0.71501    0.19616  -3.6451 0.0005600 ***
package9            0.00000    0.00000
package1:sampleA1  -0.52570    0.19616  -2.6800 0.0094902 **
package1:sampleA2  -1.09124    0.19616  -5.5631 6.503e-07 ***
package1:sampleA3   0.00000    0.00000
package10:sampleA1  0.36835    0.19616   1.8779 0.0652619 .
package10:sampleA2 -0.57562    0.19616  -2.9345 0.0047275 **
package10:sampleA3  0.00000    0.00000
package11:sampleA1  0.30298    0.19616   1.5446 0.1277034
package11:sampleA2  0.34699    0.19616   1.7690 0.0819836 .
package11:sampleA3  0.00000    0.00000
package12:sampleA1  0.48746    0.19616   2.4851 0.0157584 *
package12:sampleA2  0.45769    0.19616   2.3333 0.0230013 *
package12:sampleA3  0.00000    0.00000
package13:sampleA1 -0.27369    0.19616  -1.3953 0.1680716
package13:sampleA2 -1.23093    0.19616  -6.2752 4.243e-08 ***
package13:sampleA3  0.00000    0.00000
package14:sampleA1  0.65235    0.19616   3.3256 0.0015089 **
package14:sampleA2  1.60043    0.19616   8.1590 2.625e-11 ***
package14:sampleA3  0.00000    0.00000
package15:sampleA1  0.84917    0.19616   4.3291 5.770e-05 ***
package15:sampleA2 -0.54462    0.19616  -2.7764 0.0073206 **
package15:sampleA3  0.00000    0.00000
package16:sampleA1  0.61863    0.19616   3.1538 0.0025178 **
package16:sampleA2 -0.19465    0.19616  -0.9923 0.3250282
package16:sampleA3  0.00000    0.00000
package17:sampleA1  0.32227    0.19616   1.6429 0.1056276
package17:sampleA2 -0.79379    0.19616  -4.0467 0.0001508 ***
package17:sampleA3  0.00000    0.00000
package18:sampleA1  0.94770    0.19616   4.8314 9.762e-06 ***
```

```
package18:sampleA2   0.18877     0.19616   0.9623 0.3397458
package18:sampleA3   0.00000     0.00000
package19:sampleA1  -0.16228     0.19616  -0.8273 0.4113450
package19:sampleA2  -0.81114     0.19616  -4.1352 0.0001120 ***
package19:sampleA3   0.00000     0.00000
package2:sampleA1    0.77575     0.19616   3.9548 0.0002049 ***
package2:sampleA2    0.98663     0.19616   5.0298 4.741e-06 ***
package2:sampleA3    0.00000     0.00000
package20:sampleA1  -1.01138     0.19616  -5.1560 2.980e-06 ***
package20:sampleA2  -0.59234     0.19616  -3.0197 0.0037126 **
package20:sampleA3   0.00000     0.00000
package3:sampleA1   -0.39744     0.19616  -2.0262 0.0472007 *
package3:sampleA2   -0.29306     0.19616  -1.4940 0.1404174
package3:sampleA3    0.00000     0.00000
package4:sampleA1   -0.31976     0.19616  -1.6301 0.1083175
package4:sampleA2   -1.63645     0.19616  -8.3426 1.278e-11 ***
package4:sampleA3    0.00000     0.00000
package5:sampleA1    0.88257     0.19616   4.4993 3.188e-05 ***
package5:sampleA2    0.61557     0.19616   3.1382 0.0026355 **
package5:sampleA3    0.00000     0.00000
package6:sampleA1   -0.73405     0.19616  -3.7422 0.0004105 ***
package6:sampleA2   -0.43175     0.19616  -2.2011 0.0315906 *
package6:sampleA3    0.00000     0.00000
package7:sampleA1   -0.56541     0.19616  -2.8825 0.0054684 **
package7:sampleA2   -0.06881     0.19616  -0.3508 0.7269701
package7:sampleA3    0.00000     0.00000
package8:sampleA1   -0.11367     0.19616  -0.5795 0.5644332
package8:sampleA2    0.37569     0.19616   1.9153 0.0602278 .
package8:sampleA3    0.00000     0.00000
package9:sampleA1   -0.27176     0.19616  -1.3854 0.1710573
package9:sampleA2   -0.08033     0.19616  -0.4095 0.6836214
package9:sampleA3    0.00000     0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.3.2 p116

(27) MODEL

```
GLM(Y ~ method + variety + method:variety, p75l) # p116
```

```
$ANOVA
Response : Y
            Df Sum Sq Mean Sq F value    Pr(>F)
MODEL       14 1339.0  95.645  4.8674 2.723e-06 ***
RESIDUALS   75 1473.8  19.650
```

52

```
CORRECTED TOTAL 89 2812.8
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
              Df Sum Sq Mean Sq F value    Pr(>F)
method         2 953.16  476.58 24.2531 7.525e-09 ***
variety        4  11.38    2.85  0.1448   0.96476
method:variety 8 374.49   46.81  2.3822   0.02409 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
              Df Sum Sq Mean Sq F value    Pr(>F)
method         2 953.16  476.58 24.2531 7.525e-09 ***
variety        4  11.38    2.85  0.1448   0.96476
method:variety 8 374.49   46.81  2.3822   0.02409 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
              Df Sum Sq Mean Sq F value    Pr(>F)
method         2 953.16  476.58 24.2531 7.525e-09 ***
variety        4  11.38    2.85  0.1448   0.96476
method:variety 8 374.49   46.81  2.3822   0.02409 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
                  Estimate Std. Error t value  Pr(>|t|)
(Intercept)        12.5500     1.8097  6.9348  1.23e-09 ***
methoda             9.7833     2.5593  3.8226 0.0002707 ***
methodb             6.6667     2.5593  2.6049 0.0110772 *
methodc             0.0000     0.0000
variety1            5.8667     2.5593  2.2923 0.0246955 *
variety2            7.3667     2.5593  2.8784 0.0052049 **
variety3            4.7667     2.5593  1.8625 0.0664519 .
variety4            2.2833     2.5593  0.8922 0.3751569
variety5            0.0000     0.0000
methoda:variety1   -6.4333     3.6194 -1.7775 0.0795479 .
methoda:variety2   -7.8500     3.6194 -2.1689 0.0332634 *
methoda:variety3   -3.9667     3.6194 -1.0959 0.2766108
methoda:variety4    1.3500     3.6194  0.3730 0.7102090
methoda:variety5    0.0000     0.0000
methodb:variety1  -10.0000     3.6194 -2.7629 0.0072031 **
methodb:variety2  -11.3500     3.6194 -3.1359 0.0024473 **
methodb:variety3   -8.5333     3.6194 -2.3577 0.0210000 *
methodb:variety4   -8.0000     3.6194 -2.2103 0.0301340 *
```

```
methodb:variety5    0.0000        0.0000
methodc:variety1    0.0000        0.0000
methodc:variety2    0.0000        0.0000
methodc:variety3    0.0000        0.0000
methodc:variety4    0.0000        0.0000
methodc:variety5    0.0000        0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.3.3 p122

(28) MODEL

```
p122 = read.table("C:/G/Rt/SAS4lm/p122.txt", header=TRUE)
p122 = af(p122, c("et", "wafer", "pos"))
GLM(resista ~ et + wafer %in% et + pos + et:pos, p122)
```

```
$ANOVA
Response : resista
                Df  Sum Sq Mean Sq F value   Pr(>F)
MODEL           23  9.3250 0.40544  3.6477 0.001263 **
RESIDUALS       24  2.6676 0.11115
CORRECTED TOTAL 47 11.9926
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
         Df Sum Sq Mean Sq F value     Pr(>F)
et        3 3.1122 1.03739  9.3333 0.0002851 ***
et:wafer  8 4.2745 0.53431  4.8071 0.0012742 **
pos       3 1.1289 0.37630  3.3855 0.0345139 *
et:pos    9 0.8095 0.08994  0.8092 0.6125279
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
         Df Sum Sq Mean Sq F value     Pr(>F)
et        3 3.1122 1.03739  9.3333 0.0002851 ***
et:wafer  8 4.2745 0.53431  4.8071 0.0012742 **
pos       3 1.1289 0.37630  3.3855 0.0345139 *
et:pos    9 0.8095 0.08994  0.8092 0.6125279
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
         Df Sum Sq Mean Sq F value     Pr(>F)
```

```
et          3 3.1122 1.03739  9.3333 0.0002851 ***
et:wafer    8 4.2745 0.53431  4.8071 0.0012742 **
pos         3 1.1289 0.37630  3.3855 0.0345139 *
et:pos      9 0.8095 0.08994  0.8092 0.6125279
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   6.1775    0.23574 26.2044 < 2.2e-16 ***
et1          -0.8017    0.33339 -2.4046  0.024265 *
et2          -0.1792    0.33339 -0.5374  0.595934
et3          -0.0467    0.33339 -0.1400  0.889847
et4           0.0000    0.00000
et1:wafer1    0.7025    0.23574  2.9799  0.006508 **
et1:wafer2    0.8300    0.23574  3.5208  0.001750 **
et1:wafer3    0.0000    0.00000
et2:wafer1   -0.0800    0.23574 -0.3394  0.737295
et2:wafer2   -0.1650    0.23574 -0.6999  0.490709
et2:wafer3    0.0000    0.00000
et3:wafer1   -0.5125    0.23574 -2.1740  0.039796 *
et3:wafer2    0.4000    0.23574  1.6968  0.102675
et3:wafer3    0.0000    0.00000
et4:wafer1    0.6850    0.23574  2.9057  0.007755 **
et4:wafer2    0.4025    0.23574  1.7074  0.100660
et4:wafer3    0.0000    0.00000
pos1         -0.2000    0.27221 -0.7347  0.469628
pos2          0.0133    0.27221  0.0490  0.961339
pos3         -0.6433    0.27221 -2.3634  0.026551 *
pos4          0.0000    0.00000
et1:pos1     -0.0733    0.38497 -0.1905  0.850525
et1:pos2     -0.4500    0.38497 -1.1689  0.253910
et1:pos3      0.3100    0.38497  0.8053  0.428573
et1:pos4      0.0000    0.00000
et2:pos1      0.2767    0.38497  0.7187  0.479279
et2:pos2      0.2567    0.38497  0.6667  0.511307
et2:pos3      0.4933    0.38497  1.2815  0.212262
et2:pos4      0.0000    0.00000
et3:pos1      0.2433    0.38497  0.6321  0.533304
et3:pos2      0.2400    0.38497  0.6234  0.538882
et3:pos3      0.3233    0.38497  0.8399  0.409254
et3:pos4      0.0000    0.00000
et4:pos1      0.0000    0.00000
et4:pos2      0.0000    0.00000
et4:pos3      0.0000    0.00000
et4:pos4      0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.3.4 p136

(29) MODEL

```
p136 = read.table("C:/G/Rt/SAS4lm/p136.txt", header=TRUE)
p136 = af(p136, "rep")
GLM(drywt ~ rep + cult + rep:cult + inoc + cult:inoc, p136)
```

```
$ANOVA
Response : drywt
                Df  Sum Sq Mean Sq F value    Pr(>F)
MODEL           11 157.208 14.2917   20.26 4.594e-06 ***
RESIDUALS       12   8.465  0.7054
CORRECTED TOTAL 23 165.673
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
          Df  Sum Sq Mean Sq F value    Pr(>F)
rep        3  25.320   8.440 11.9646 0.0006428 ***
cult       1   2.407   2.407  3.4117 0.0895283 .
rep:cult   3   9.480   3.160  4.4796 0.0249095 *
inoc       2 118.176  59.088 83.7631 8.919e-08 ***
cult:inoc  2   1.826   0.913  1.2942 0.3097837
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
          Df  Sum Sq Mean Sq F value    Pr(>F)
rep        3  25.320   8.440 11.9646 0.0006428 ***
cult       1   2.407   2.407  3.4117 0.0895283 .
rep:cult   3   9.480   3.160  4.4796 0.0249095 *
inoc       2 118.176  59.088 83.7631 8.919e-08 ***
cult:inoc  2   1.826   0.913  1.2942 0.3097837
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
          Df  Sum Sq Mean Sq F value    Pr(>F)
rep        3  25.320   8.440 11.9646 0.0006428 ***
cult       1   2.407   2.407  3.4117 0.0895283 .
rep:cult   3   9.480   3.160  4.4796 0.0249095 *
inoc       2 118.176  59.088 83.7631 8.919e-08 ***
cult:inoc  2   1.826   0.913  1.2942 0.3097837
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
              Estimate Std. Error t value   Pr(>|t|)
(Intercept)    31.4917     0.59389 53.0259 1.332e-15 ***
rep1            3.4000     0.68577  4.9579 0.0003319 ***
rep2            3.8000     0.68577  5.5412 0.0001275 ***
rep3            0.9333     0.68577  1.3610 0.1985240
rep4            0.0000     0.00000
cultA           0.6917     0.83989  0.8235 0.4262768
cultB           0.0000     0.00000
rep1:cultA     -2.0000     0.96982 -2.0622 0.0615275 .
rep1:cultB      0.0000     0.00000
rep2:cultA     -2.6000     0.96982 -2.6809 0.0200035 *
rep2:cultB      0.0000     0.00000
rep3:cultA      0.3333     0.96982  0.3437 0.7370149
rep3:cultB      0.0000     0.00000
rep4:cultA      0.0000     0.00000
rep4:cultB      0.0000     0.00000
inocCON        -5.5000     0.59389 -9.2609 8.156e-07 ***
inocDEA        -2.8750     0.59389 -4.8409 0.0004044 ***
inocLIV         0.0000     0.00000
cultA:inocCON   0.2500     0.83989  0.2977 0.7710547
cultA:inocDEA  -1.0250     0.83989 -1.2204 0.2457544
cultA:inocLIV   0.0000     0.00000
cultB:inocCON   0.0000     0.00000
cultB:inocDEA   0.0000     0.00000
cultB:inocLIV   0.0000     0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.4 Chapter 5

5.4.1 p142

(30) MODEL

```
p142 = read.table("C:/G/Rt/SAS4lm/p142.txt", header=TRUE, na.strings=".")
p142 = af(p142, c("STUDY", "PATIENT"))
GLM(FLUSH ~ STUDY + TRT, p142) # Incomplete data, 56 lines are truncated.
```

```
$ANOVA
Response : FLUSH
                 Df  Sum Sq Mean Sq F value  Pr(>F)
MODEL             5  3619.9  723.98   2.392 0.04607 *
RESIDUALS        71 21489.2  302.67
CORRECTED TOTAL  76 25109.1
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
      Df Sum Sq Mean Sq F value  Pr(>F)
STUDY  4 3553.9  888.46  2.9355 0.02638 *
TRT    1   66.0   66.04  0.2182 0.64185
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
      Df Sum Sq Mean Sq F value  Pr(>F)
STUDY  4 3599.4  899.85  2.9731 0.02496 *
TRT    1   66.0   66.04  0.2182 0.64185
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
      Df Sum Sq Mean Sq F value  Pr(>F)
STUDY  4 3599.4  899.85  2.9731 0.02496 *
TRT    1   66.0   66.04  0.2182 0.64185
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)  20.7038     5.1627  4.0103 0.0001481 ***
STUDY42      18.8049    11.1730  1.6831 0.0967562 .
STUDY43       3.3539     5.8408  0.5742 0.5676300
STUDY44      -9.6707     7.1273 -1.3569 0.1791234
STUDY45       9.6932     6.0879  1.5922 0.1157835
STUDY46       0.0000     0.0000
TRTA         -1.8583     3.9782 -0.4671 0.6418492
TRTB          0.0000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


 (31) MODEL
```

```
GLM(FLUSH ~ TRT + STUDY + TRT:STUDY, p142) # Different data
```

```
$ANOVA
Response : FLUSH
                Df  Sum Sq Mean Sq F value Pr(>F)
MODEL            9  4093.7  454.86  1.4501 0.1851
RESIDUALS       67 21015.4  313.66
CORRECTED TOTAL 76 25109.1
```

```
$`Type I`
          Df Sum Sq Mean Sq F value  Pr(>F)
TRT        1   20.5   20.49  0.0653 0.79906
STUDY      4 3599.4  899.85  2.8688 0.02956 *
TRT:STUDY  4  473.8  118.45  0.3776 0.82383
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
          Df Sum Sq Mean Sq F value  Pr(>F)
TRT        1   66.0   66.04  0.2105 0.64783
STUDY      4 3599.4  899.85  2.8688 0.02956 *
TRT:STUDY  4  473.8  118.45  0.3776 0.82383
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
          Df Sum Sq Mean Sq F value Pr(>F)
TRT        1    1.9    1.93  0.0062 0.9377
STUDY      4 3339.4  834.85  2.6616 0.0400 *
TRT:STUDY  4  473.8  118.45  0.3776 0.8238
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
              Estimate Std. Error t value  Pr(>|t|)
(Intercept)    24.2321     6.6940  3.6200 0.0005671 ***
TRTA           -9.5030     9.8532 -0.9645 0.3382875
TRTB            0.0000     0.0000
STUDY42         4.1012    18.9334  0.2166 0.8291705
STUDY43         0.3108     8.1984  0.0379 0.9698723
STUDY44       -12.8822     9.8532 -1.3074 0.1955439
STUDY45         4.1451     8.5629  0.4841 0.6299091
STUDY46         0.0000     0.0000
TRTA:STUDY42   24.4078    23.8240  1.0245 0.3092815
TRTA:STUDY43    6.6743    11.9120  0.5603 0.5771416
TRTA:STUDY44    6.9476    14.5635  0.4771 0.6348740
TRTA:STUDY45   11.6841    12.4143  0.9412 0.3499931
TRTA:STUDY46    0.0000     0.0000
TRTB:STUDY42    0.0000     0.0000
TRTB:STUDY43    0.0000     0.0000
TRTB:STUDY44    0.0000     0.0000
TRTB:STUDY45    0.0000     0.0000
TRTB:STUDY46    0.0000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.5 Chapter 6

5.5.1 p171

(32) MODEL

```
p171 = read.table("C:/G/Rt/SAS4lm/p171.txt", header=TRUE)
GLM(score2 ~ teach, p171) # p173 Output 6.2, p174 Output 6.5
```

```
$ANOVA
Response : score2
                Df  Sum Sq Mean Sq F value Pr(>F)
MODEL            2   49.74  24.868  0.5598 0.5776
RESIDUALS       28 1243.94  44.426
CORRECTED TOTAL 30 1293.68

$`Type I`
      Df Sum Sq Mean Sq F value Pr(>F)
teach  2 49.736  24.868  0.5598 0.5776

$`Type II`
      Df Sum Sq Mean Sq F value Pr(>F)
teach  2 49.736  24.868  0.5598 0.5776

$`Type III`
      Df Sum Sq Mean Sq F value Pr(>F)
teach  2 49.736  24.868  0.5598 0.5776

$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   72.455     2.0097 36.0530   <2e-16 ***
teachJAY       3.545     3.3828  1.0481   0.3036
teachPAT       0.903     2.6855  0.3361   0.7393
teachROBIN     0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.5.2 p188

(33) MODEL

```
p188 = read.table("C:/G/Rt/SAS4lm/p188.txt", header=TRUE)
p188 = af(p188, c("a", "b"))
GLM(y ~ a + b + a:b, p188) # p189
```

```
$ANOVA
```

60

```
Response : y
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            5 63.711 12.7422    5.866 0.005724 **
RESIDUALS       12 26.067   2.1722
CORRECTED TOTAL 17 89.778
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
    Df Sum Sq Mean Sq F value   Pr(>F)
a    1  7.803  7.8028  3.5921 0.082395 .
b    2 20.492 10.2459  4.7168 0.030798 *
a:b  2 35.416 17.7082  8.1521 0.005807 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
    Df Sum Sq Mean Sq F value   Pr(>F)
a    1 15.850  15.850  7.2968 0.019265 *
b    2 20.492  10.246  4.7168 0.030798 *
a:b  2 35.416  17.708  8.1521 0.005807 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
    Df Sum Sq Mean Sq F value   Pr(>F)
a    1  9.641  9.6407  4.4382 0.056865 .
b    2 30.866 15.4330  7.1047 0.009212 **
a:b  2 35.416 17.7082  8.1521 0.005807 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   5.4000    0.65912  8.1927 2.944e-06 ***
a1           -4.4000    1.61452 -2.7253  0.018427 *
a2            0.0000    0.00000
b1           -2.9000    1.23311 -2.3518  0.036594 *
b2            2.9333    1.07634  2.7253  0.018427 *
b3            0.0000    0.00000
a1:b1         7.4000    2.18607  3.3851  0.005417 **
a1:b2         0.6667    1.94041  0.3436  0.737114
a1:b3         0.0000    0.00000
a2:b1         0.0000    0.00000
a2:b2         0.0000    0.00000
a2:b3         0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.5.3 p203

(34) MODEL

```
GLM(y ~ a + b + a:b, p188[-8,])
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value  Pr(>F)
MODEL            4 45.816 11.4539  5.2729 0.01097 *
RESIDUALS       12 26.067  2.1722
CORRECTED TOTAL 16 71.882
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
    Df  Sum Sq Mean Sq F value    Pr(>F)
a    1  2.9252  2.9252  1.3466 0.268432
b    2 13.3224  6.6612  3.0665 0.083997 .
a:b  1 29.5681 29.5681 13.6119 0.003095 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
    Df  Sum Sq Mean Sq F value    Pr(>F)
a    1  5.5652  5.5652  2.5620 0.135442
b    2 13.3224  6.6612  3.0665 0.083997 .
a:b  1 29.5681 29.5681 13.6119 0.003095 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
    Df  Sum Sq Mean Sq F value    Pr(>F)
a    1  0.3507  0.3507  0.1615 0.694881
b    2 16.0733  8.0367  3.6997 0.056021 .
a:b  1 29.5681 29.5681 13.6119 0.003095 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   5.4000    0.65912  8.1927 2.944e-06 ***
a1           -3.7333    1.07634 -3.4685  0.004644 **
a2            0.0000    0.00000
b1           -2.9000    1.23311 -2.3518  0.036594 *
b2            2.9333    1.07634  2.7253  0.018427 *
b3            0.0000    0.00000
```

```
a1:b1          6.7333    1.82503  3.6894  0.003095 **
a1:b2          0.0000    0.00000
a1:b3          0.0000    0.00000
a2:b1          0.0000    0.00000
a2:b2          0.0000    0.00000
a2:b3          0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.5.4 p215

(35) MODEL

```
p215 = read.table("C:/G/Rt/SAS4lm/p215.txt", header=TRUE)
p215 = af(p215, c("irrig", "reps"))
GLM(yield ~ irrig/reps + cult + irrig:cult, p215) # p216 Book is wrong.
```

```
$ANOVA
Response : yield
                Df  Sum Sq Mean Sq F value Pr(>F)
MODEL           11  67.662  6.1511   0.6253 0.7636
RESIDUALS        6  59.023  9.8372
CORRECTED TOTAL 17 126.685

$`Type I`
           Df Sum Sq Mean Sq F value Pr(>F)
irrig       2  7.320  3.6600   0.3721 0.7042
irrig:reps  6 59.870  9.9783   1.0143 0.4933
cult        1  0.467  0.4672   0.0475 0.8347
irrig:cult  2  0.004  0.0022   0.0002 0.9998

$`Type II`
           Df Sum Sq Mean Sq F value Pr(>F)
irrig       2  7.320  3.6600   0.3721 0.7042
irrig:reps  6 59.870  9.9783   1.0143 0.4933
cult        1  0.467  0.4672   0.0475 0.8347
irrig:cult  2  0.004  0.0022   0.0002 0.9998

$`Type III`
           Df Sum Sq Mean Sq F value Pr(>F)
irrig       2  7.320  3.6600   0.3721 0.7042
irrig:reps  6 59.870  9.9783   1.0143 0.4933
cult        1  0.467  0.4672   0.0475 0.8347
irrig:cult  2  0.004  0.0022   0.0002 0.9998

$Parameter
```

```
           Estimate Std. Error t value  Pr(>|t|)
(Intercept)  30.6667     2.5609 11.9750 2.055e-05 ***
irrig1        2.6333     3.6216  0.7271    0.4945
irrig2        3.5833     3.6216  0.9894    0.3607
irrig3        0.0000     0.0000
irrig1:reps1 -4.9000     3.1364 -1.5623    0.1692
irrig1:reps2 -1.5000     3.1364 -0.4783    0.6494
irrig1:reps3  0.0000     0.0000
irrig2:reps1 -5.6000     3.1364 -1.7855    0.1244
irrig2:reps2 -3.3500     3.1364 -1.0681    0.3266
irrig2:reps3  0.0000     0.0000
irrig3:reps1 -1.7000     3.1364 -0.5420    0.6073
irrig3:reps2 -0.8000     3.1364 -0.2551    0.8072
irrig3:reps3  0.0000     0.0000
cultA         0.3667     2.5609  0.1432    0.8908
cultB         0.0000     0.0000
irrig1:cultA -0.0667     3.6216 -0.0184    0.9859
irrig1:cultB  0.0000     0.0000
irrig2:cultA -0.0667     3.6216 -0.0184    0.9859
irrig2:cultB  0.0000     0.0000
irrig3:cultA  0.0000     0.0000
irrig3:cultB  0.0000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# Compare with SAS output
```

 (36) MODEL

```
GLM(yield ~ reps + irrig + reps:irrig + cult + cult:irrig, p215)
```

```
$ANOVA
Response : yield
                Df  Sum Sq Mean Sq F value Pr(>F)
MODEL           11  67.662  6.1511  0.6253 0.7636
RESIDUALS        6  59.023  9.8372
CORRECTED TOTAL 17 126.685


$`Type I`
           Df Sum Sq Mean Sq F value Pr(>F)
reps        2 49.703 24.8517  2.5263 0.1600
irrig       2  7.320  3.6600  0.3721 0.7042
reps:irrig  4 10.167  2.5417  0.2584 0.8944
cult        1  0.467  0.4672  0.0475 0.8347
irrig:cult  2  0.004  0.0022  0.0002 0.9998
```

```
$`Type II`
            Df Sum Sq Mean Sq F value Pr(>F)
reps         2 49.703 24.8517  2.5263 0.1600
irrig        2  7.320  3.6600  0.3721 0.7042
reps:irrig   4 10.167  2.5417  0.2584 0.8944
cult         1  0.467  0.4672  0.0475 0.8347
irrig:cult   2  0.004  0.0022  0.0002 0.9998

$`Type III`
            Df Sum Sq Mean Sq F value Pr(>F)
reps         2 49.703 24.8517  2.5263 0.1600
irrig        2  7.320  3.6600  0.3721 0.7042
reps:irrig   4 10.167  2.5417  0.2584 0.8944
cult         1  0.467  0.4672  0.0475 0.8347
irrig:cult   2  0.004  0.0022  0.0002 0.9998

$Parameter
              Estimate Std. Error t value  Pr(>|t|)
(Intercept)    30.6667     2.5609 11.9750 2.055e-05 ***
reps1          -1.7000     3.1364 -0.5420    0.6073
reps2          -0.8000     3.1364 -0.2551    0.8072
reps3           0.0000     0.0000
irrig1          2.6333     3.6216  0.7271    0.4945
irrig2          3.5833     3.6216  0.9894    0.3607
irrig3          0.0000     0.0000
reps1:irrig1   -3.2000     4.4356 -0.7214    0.4978
reps1:irrig2   -3.9000     4.4356 -0.8793    0.4131
reps1:irrig3    0.0000     0.0000
reps2:irrig1   -0.7000     4.4356 -0.1578    0.8798
reps2:irrig2   -2.5500     4.4356 -0.5749    0.5863
reps2:irrig3    0.0000     0.0000
reps3:irrig1    0.0000     0.0000
reps3:irrig2    0.0000     0.0000
reps3:irrig3    0.0000     0.0000
cultA           0.3667     2.5609  0.1432    0.8908
cultB           0.0000     0.0000
irrig1:cultA   -0.0667     3.6216 -0.0184    0.9859
irrig1:cultB    0.0000     0.0000
irrig2:cultA   -0.0667     3.6216 -0.0184    0.9859
irrig2:cultB    0.0000     0.0000
irrig3:cultA    0.0000     0.0000
irrig3:cultB    0.0000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.6 Chapter 7

5.6.1 p232

 (37) MODEL

```
p232 = read.table("C:/G/Rt/SAS4lm/p232.txt", header=TRUE)
p232 = af(p232, c("trt", "rep"))
GLM(final ~ trt + initial, p232) # p233
```

```
$ANOVA
Response : final
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            5 354.45  70.889  235.05 5.493e-13 ***
RESIDUALS       14   4.22   0.302
CORRECTED TOTAL 19 358.67
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
       Df Sum Sq Mean Sq F value    Pr(>F)
trt     4 198.41  49.602  164.47 1.340e-11 ***
initial 1 156.04 156.040  517.38 1.867e-12 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
       Df  Sum Sq Mean Sq F value    Pr(>F)
trt     4  12.089   3.022  10.021 0.0004819 ***
initial 1 156.040 156.040 517.384 1.867e-12 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
       Df  Sum Sq Mean Sq F value    Pr(>F)
trt     4  12.089   3.022  10.021 0.0004819 ***
initial 1 156.040 156.040 517.384 1.867e-12 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)  2.49486    1.02786  2.4272  0.029298 *
trt1        -0.24446    0.57658 -0.4240  0.678022
trt2        -0.28027    0.49291 -0.5686  0.578630
trt3         1.65476    0.42943  3.8534  0.001756 **
trt4         1.10711    0.47175  2.3468  0.034170 *
```

```
trt5           0.00000    0.00000
initial        1.08318    0.04762 22.7461 1.867e-12 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.6.2 p240

(38) MODEL

```
GLM(final ~ initial + trt + trt:initial, p232) # p240
```

```
$ANOVA
Response : final
                Df Sum Sq Mean Sq F value     Pr(>F)
MODEL            9 355.84  39.537  139.51 2.572e-09 ***
RESIDUALS       10   2.83   0.283
CORRECTED TOTAL 19 358.67
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
            Df Sum Sq Mean Sq   F value     Pr(>F)
initial      1 342.36  342.36 1208.0336 9.211e-12 ***
trt          4  12.09    3.02   10.6645  0.001247 **
initial:trt  4   1.39    0.35    1.2247  0.360175
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
            Df  Sum Sq Mean Sq  F value     Pr(>F)
initial      1 156.040 156.040 550.5987 4.478e-10 ***
trt          4  12.089   3.022  10.6645  0.001247 **
initial:trt  4   1.388   0.347   1.2247  0.360175
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
            Df Sum Sq Mean Sq  F value    Pr(>F)
initial      1 68.529  68.529 241.8091 2.472e-08 ***
trt          4  1.696   0.424   1.4963    0.2752
initial:trt  4  1.388   0.347   1.2247    0.3602
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
```

```
(Intercept)   -0.4318    2.1328 -0.2025    0.8436
initial        1.2239    0.1017 12.0298 2.854e-07 ***
trt1           5.6731    3.5715  1.5884    0.1433
trt2          -8.7175    8.9578 -0.9732    0.3534
trt3           5.2498    3.4875  1.5053    0.1632
trt4           4.7276    2.9399  1.6081    0.1389
trt5           0.0000    0.0000
initial:trt1  -0.2412    0.1398 -1.7256    0.1151
initial:trt2   0.2775    0.3358  0.8263    0.4279
initial:trt3  -0.1678    0.1509 -1.1123    0.2920
initial:trt4  -0.1670    0.1269 -1.3153    0.2178
initial:trt5   0.0000    0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.6.3 p241

(39) MODEL

```
p241 = read.table("C:/G/Rt/SAS4lm/p241.txt", header=TRUE)
p241 = af(p241, c("STORE", "DAY"))
GLM(Q1 ~ P1 + DAY + P1:DAY, p241) # p242
```

```
$ANOVA
Response : Q1
                Df  Sum Sq Mean Sq F value    Pr(>F)
MODEL           11 1111.52 101.048  4.6445 0.0008119 ***
RESIDUALS       24  522.15  21.756
CORRECTED TOTAL 35 1633.68
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
       Df Sum Sq Mean Sq F value    Pr(>F)
P1      1 516.59  516.59 23.7444 5.739e-05 ***
DAY     5 430.54   86.11  3.9578  0.009275 **
P1:DAY  5 164.39   32.88  1.5112  0.223566
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
       Df Sum Sq Mean Sq F value    Pr(>F)
P1      1 696.73  696.73 32.0243 7.925e-06 ***
DAY     5 430.54   86.11  3.9578  0.009275 **
P1:DAY  5 164.39   32.88  1.5112  0.223566
---
```

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
        Df Sum Sq Mean Sq F value   Pr(>F)
P1   1 554.79 554.79 25.4999 3.665e-05 ***
DAY   5 201.17   40.23 1.8493   0.1412
P1:DAY   5 164.39   32.88 1.5112   0.2236

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   73.273   13.4837 5.4341 1.39e-05 ***
P1   -1.225   0.2652 -4.6199 0.0001092 ***
DAY1   -54.597   19.7355 -2.7664 0.0107321 *
DAY2   -34.786   20.2511 -1.7177 0.0987253 .
DAY3   -27.943   29.4284 -0.9495 0.3518193
DAY4   -24.123   21.3933 -1.1276 0.2706307
DAY5   4.626   30.6284 0.1510 0.8812016
DAY6   0.000   0.0000
P1:DAY1   1.005   0.3941 2.5494 0.0175983 *
P1:DAY2   0.602   0.3988 1.5088 0.1444129
P1:DAY3   0.614   0.5703 1.0768 0.2922646
P1:DAY4   0.430   0.4151 1.0349 0.3110314
P1:DAY5   0.029   0.5703 0.0515 0.9593643
P1:DAY6   0.000   0.0000

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

5.6.4 p243

 (40) MODEL

```
GLM(Q1 ~ DAY + DAY:P1, p241)
```


$ANOVA
Response : Q1
                Df   Sum Sq Mean Sq F value   Pr(>F)
MODEL   11 1111.52 101.048 4.6445 0.0008119 ***
RESIDUALS   24 522.15 21.756
CORRECTED TOTAL 35 1633.68

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
        Df Sum Sq Mean Sq F value   Pr(>F)

```
DAY    5 250.40  50.079  2.3018 0.0764717 .
DAY:P1 6 861.13 143.521  6.5967 0.0003239 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
       Df Sum Sq Mean Sq F value    Pr(>F)
DAY    5 250.40  50.079  2.3018 0.0764717 .
DAY:P1 6 861.13 143.521  6.5967 0.0003239 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
       Df Sum Sq Mean Sq F value    Pr(>F)
DAY    5 201.17  40.234  1.8493 0.1411648
DAY:P1 6 861.13 143.521  6.5967 0.0003239 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
           Estimate Std. Error t value  Pr(>|t|)
(Intercept)  73.273    13.4837  5.4341  1.39e-05 ***
DAY1        -54.597    19.7355 -2.7664 0.0107321 *
DAY2        -34.786    20.2511 -1.7177 0.0987253 .
DAY3        -27.943    29.4284 -0.9495 0.3518193
DAY4        -24.123    21.3933 -1.1276 0.2706307
DAY5          4.626    30.6284  0.1510 0.8812016
DAY6          0.000     0.0000
DAY1:P1      -0.220     0.2915 -0.7562 0.4568599
DAY2:P1      -0.624     0.2978 -2.0940 0.0470031 *
DAY3:P1      -0.611     0.5049 -1.2102 0.2379998
DAY4:P1      -0.796     0.3193 -2.4914 0.0200350 *
DAY5:P1      -1.196     0.5049 -2.3683 0.0262648 *
DAY6:P1      -1.225     0.2652 -4.6199 0.0001092 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

`REG(Q1 ~ DAY + DAY:P1, p241, NOINT=TRUE)` *# Ouput 7.10*

```
       Estimate Std. Error t value  Pr(>|t|)
DAY1     18.675    14.4110  1.2959 0.2073286
DAY2     38.487    15.1094  2.5472 0.0176863 *
DAY3     45.330    26.1576  1.7329 0.0959384 .
DAY4     49.149    16.6092  2.9592 0.0068366 **
DAY5     77.899    27.5007  2.8326 0.0092034 **
DAY6     73.273    13.4837  5.4341  1.39e-05 ***
DAY1:P1  -0.220     0.2915 -0.7562 0.4568599
```

```
DAY2:P1   -0.624     0.2978 -2.0940 0.0470031 *
DAY3:P1   -0.611     0.5049 -1.2102 0.2379998
DAY4:P1   -0.796     0.3193 -2.4914 0.0200350 *
DAY5:P1   -1.196     0.5049 -2.3683 0.0262648 *
DAY6:P1   -1.225     0.2652 -4.6199 0.0001092 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

 (41) MODEL

`GLM(Q1 ~ P1 + DAY + P1:DAY, p241)`

```
$ANOVA
Response : Q1
                Df  Sum Sq Mean Sq F value     Pr(>F)
MODEL           11 1111.52 101.048  4.6445 0.0008119 ***
RESIDUALS       24  522.15  21.756
CORRECTED TOTAL 35 1633.68
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
       Df Sum Sq Mean Sq F value     Pr(>F)
P1      1 516.59  516.59 23.7444 5.739e-05 ***
DAY     5 430.54   86.11  3.9578  0.009275 **
P1:DAY  5 164.39   32.88  1.5112  0.223566
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
       Df Sum Sq Mean Sq F value     Pr(>F)
P1      1 696.73  696.73 32.0243 7.925e-06 ***
DAY     5 430.54   86.11  3.9578  0.009275 **
P1:DAY  5 164.39   32.88  1.5112  0.223566
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
       Df Sum Sq Mean Sq F value    Pr(>F)
P1      1 554.79  554.79 25.4999 3.665e-05 ***
DAY     5 201.17   40.23  1.8493    0.1412
P1:DAY  5 164.39   32.88  1.5112    0.2236
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
           Estimate Std. Error t value  Pr(>|t|)
```

```
(Intercept)    73.273    13.4837  5.4341  1.39e-05 ***
P1             -1.225     0.2652 -4.6199 0.0001092 ***
DAY1          -54.597    19.7355 -2.7664 0.0107321 *
DAY2          -34.786    20.2511 -1.7177 0.0987253 .
DAY3          -27.943    29.4284 -0.9495 0.3518193
DAY4          -24.123    21.3933 -1.1276 0.2706307
DAY5            4.626    30.6284  0.1510 0.8812016
DAY6            0.000     0.0000
P1:DAY1         1.005     0.3941  2.5494 0.0175983 *
P1:DAY2         0.602     0.3988  1.5088 0.1444129
P1:DAY3         0.614     0.5703  1.0768 0.2922646
P1:DAY4         0.430     0.4151  1.0349 0.3110314
P1:DAY5         0.029     0.5703  0.0515 0.9593643
P1:DAY6         0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


 (42) MODEL
```

```
GLM(Q1 ~ STORE + DAY + P1 + P2, p241)
```

```
$ANOVA
Response : Q1
                Df  Sum Sq Mean Sq F value    Pr(>F)
MODEL           12 1225.37 102.114  5.7521 0.0001688 ***
RESIDUALS       23  408.31  17.753
CORRECTED TOTAL 35 1633.68
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
STORE  5 313.42   62.68  3.5310   0.01629 *
DAY    5 250.40   50.08  2.8210   0.03957 *
P1     1 622.01  622.01 35.0377 4.924e-06 ***
P2     1  39.54   39.54  2.2274   0.14917
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
STORE  5 223.83   44.77  2.5217  0.058346 .
DAY    5 433.10   86.62  4.8793  0.003456 **
P1     1 538.17  538.17 30.3150 1.342e-05 ***
P2     1  39.54   39.54  2.2274  0.149171
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
STORE  5 223.83   44.77  2.5217  0.058346 .
DAY    5 433.10   86.62  4.8793  0.003456 **
P1     1 538.17  538.17 30.3150 1.342e-05 ***
P2     1  39.54   39.54  2.2274  0.149171
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   51.700     9.7910  5.2803 2.333e-05 ***
STORE1        -7.645     2.6919 -2.8401  0.009273 **
STORE2        -5.602     2.4642 -2.2735  0.032650 *
STORE3        -7.363     2.4642 -2.9880  0.006573 **
STORE4        -4.365     2.4875 -1.7547  0.092620 .
STORE5        -5.021     2.4361 -2.0609  0.050799 .
STORE6         0.000     0.0000
DAY1          -5.830     2.5193 -2.3143  0.029934 *
DAY2          -4.900     2.4471 -2.0024  0.057172 .
DAY3           2.270     2.5403  0.8935  0.380834
DAY4          -2.652     2.4467 -1.0841  0.289545
DAY5           4.047     2.5566  1.5830  0.127078
DAY6           0.000     0.0000
P1            -0.830     0.1508 -5.5059 1.342e-05 ***
P2             0.149     0.0997  1.4925  0.149171
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.6.5 p250

(43) MODEL

```
p250 = read.table("C:/G/Rt/SAS4lm/p250.txt", header=TRUE)
p250 = af(p250, c("variety", "spacing", "plant"))
GLM(lint ~ bollwt + variety + spacing + variety:spacing + variety:spacing:plant,
    p250) # p252 Output 7.18, Parameter is different due to different order
```

```
$ANOVA
Response : lint
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            8 31.160  3.8950  80.704 < 2.2e-16 ***
RESIDUALS       40  1.931  0.0483
CORRECTED TOTAL 48 33.091
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
                      Df  Sum Sq Mean Sq  F value    Pr(>F)
bollwt                 1 29.0693 29.0693 602.3107 < 2.2e-16 ***
variety                1  1.2635  1.2635  26.1802 8.158e-06 ***
spacing                1  0.4666  0.4666   9.6689  0.003447 **
variety:spacing        1  0.0933  0.0933   1.9325  0.172169
variety:spacing:plant  4  0.2673  0.0668   1.3847  0.256548
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
                      Df  Sum Sq Mean Sq  F value    Pr(>F)
bollwt                 1 11.1186 11.1186 230.3745 < 2.2e-16 ***
variety                1  1.1973  1.1973  24.8084 1.259e-05 ***
spacing                1  0.4666  0.4666   9.6689  0.003447 **
variety:spacing        1  0.0933  0.0933   1.9325  0.172169
variety:spacing:plant  4  0.2673  0.0668   1.3847  0.256548
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
                      Df  Sum Sq Mean Sq  F value    Pr(>F)
bollwt                 1 11.1186 11.1186 230.3745 < 2.2e-16 ***
variety                1  0.9424  0.9424  19.5269 7.379e-05 ***
spacing                1  0.3748  0.3748   7.7666  0.008101 **
variety:spacing        1  0.0479  0.0479   0.9915  0.325350
variety:spacing:plant  4  0.2673  0.0668   1.3847  0.256548
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
                            Estimate Std. Error t value  Pr(>|t|)
(Intercept)                  0.15083   0.163336  0.9234  0.361331
bollwt                       0.30561   0.020135 15.1781 < 2.2e-16 ***
variety213                  -0.42327   0.129645 -3.2649  0.002249 **
variety37                    0.00000   0.000000
spacing30                    0.06160   0.128765  0.4784  0.634964
spacing40                    0.00000   0.000000
variety213:spacing30        -0.02364   0.198980 -0.1188  0.906004
variety213:spacing40         0.00000   0.000000
variety37:spacing30          0.00000   0.000000
variety37:spacing40          0.00000   0.000000
variety213:spacing30:plant0  0.00000   0.000000
variety213:spacing30:plant3  0.33372   0.160556  2.0785  0.044120 *
variety213:spacing30:plant5  0.00000   0.000000
variety213:spacing40:plant0 -0.09849   0.111519 -0.8832  0.382418
```

```
variety213:spacing40:plant3   0.00000   0.000000
variety213:spacing40:plant5   0.00000   0.000000
variety37:spacing30:plant0    0.00000   0.000000
variety37:spacing30:plant3    0.08923   0.150334   0.5935   0.556164
variety37:spacing30:plant5    0.00000   0.000000
variety37:spacing40:plant0    0.00000   0.000000
variety37:spacing40:plant3   -0.02713   0.110857  -0.2447   0.807910
variety37:spacing40:plant5    0.00000   0.000000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.6.6   p254 Output 7.20

 (44) MODEL

```
GLM(lint ~ bollwt + variety + spacing, p250)
```

```
$ANOVA
Response : lint
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            3 30.799 10.2665  201.65 < 2.2e-16 ***
RESIDUALS       45  2.291  0.0509
CORRECTED TOTAL 48 33.091
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
        Df  Sum Sq Mean Sq  F value    Pr(>F)
bollwt   1 29.0693 29.0693 570.9531 < 2.2e-16 ***
variety  1  1.2635  1.2635  24.8172 9.777e-06 ***
spacing  1  0.4666  0.4666   9.1655  0.004072 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
        Df  Sum Sq Mean Sq  F value    Pr(>F)
bollwt   1 11.5717 11.5717 227.2815 < 2.2e-16 ***
variety  1  1.1973  1.1973  23.5168 1.516e-05 ***
spacing  1  0.4666  0.4666   9.1655  0.004072 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
        Df  Sum Sq Mean Sq  F value    Pr(>F)
bollwt   1 11.5717 11.5717 227.2815 < 2.2e-16 ***
variety  1  1.1973  1.1973  23.5168 1.516e-05 ***
```

```
spacing  1  0.4666   0.4666    9.1655   0.004072 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)  0.13371   0.153949  0.8685  0.389718
bollwt       0.30144   0.019995 15.0759 < 2.2e-16 ***
variety213  -0.41066   0.084682 -4.8494 1.516e-05 ***
variety37    0.00000   0.000000
spacing30    0.20521   0.067782  3.0275  0.004072 **
spacing40    0.00000   0.000000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.6.7 p256

(45) MODEL

```
p256 = read.table("C:/G/Rt/SAS4lm/p256.txt", header=TRUE)
p256b = af(p256, c("bloc", "type", "logdose"))
GLM(y ~ bloc + type + logdose + type:logdose, p256b) # p258 Output 7.22
```

```
$ANOVA
Response : y
                 Df  Sum Sq Mean Sq F value Pr(>F)
MODEL             8  816.50 102.063   6.0641 0.0014 **
RESIDUALS        15  252.46   16.831
CORRECTED TOTAL  23 1068.96
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
              Df Sum Sq Mean Sq F value     Pr(>F)
bloc           3 538.79 179.597 10.6709 0.0005223 ***
type           1  12.04  12.042  0.7155 0.4109264
logdose        2 121.58  60.792  3.6120 0.0524231 .
type:logdose   2 144.08  72.042  4.2804 0.0338265 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
              Df Sum Sq Mean Sq F value     Pr(>F)
bloc           3 538.79 179.597 10.6709 0.0005223 ***
type           1  12.04  12.042  0.7155 0.4109264
logdose        2 121.58  60.792  3.6120 0.0524231 .
```

```
type:logdose  2 144.08  72.042  4.2804 0.0338265 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
            Df Sum Sq Mean Sq F value     Pr(>F)
bloc          3 538.79 179.597 10.6709 0.0005223 ***
type          1  12.04  12.042  0.7155 0.4109264
logdose       2 121.58  60.792  3.6120 0.0524231 .
type:logdose  2 144.08  72.042  4.2804 0.0338265 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
                Estimate Std. Error t value  Pr(>|t|)
(Intercept)       62.042     2.5123 24.6955 1.457e-13 ***
bloc1              7.667     2.3686  3.2368  0.005531 **
bloc2             -3.500     2.3686 -1.4777  0.160183
bloc3             -4.333     2.3686 -1.8295  0.087270 .
bloc4              0.000     0.0000
type1             -8.000     2.9009 -2.7578  0.014656 *
type2              0.000     0.0000
logdose0         -11.250     2.9009 -3.8781  0.001486 **
logdose1          -7.750     2.9009 -2.6716  0.017423 *
logdose2           0.000     0.0000
type1:logdose0    11.750     4.1025  2.8641  0.011824 *
type1:logdose1     8.000     4.1025  1.9500  0.070117 .
type1:logdose2     0.000     0.0000
type2:logdose0     0.000     0.0000
type2:logdose1     0.000     0.0000
type2:logdose2     0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.6.8   p261 Output 7.27

(46) MODEL

```
p256 = af(p256, c("bloc", "type"))
p256$logd2 = (p256$logdose)^2
GLM(y ~ bloc + type + logdose + logd2 + type:logdose + type:logd2, p256)
```

```
$ANOVA
Response : y
            Df  Sum Sq Mean Sq F value Pr(>F)
MODEL        8  816.50 102.063  6.0641 0.0014 **
```

```
RESIDUALS       15  252.46  16.831
CORRECTED TOTAL 23 1068.96
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
            Df Sum Sq Mean Sq F value     Pr(>F)
bloc         3 538.79 179.597 10.6709 0.0005223 ***
type         1  12.04  12.042  0.7155 0.4109264
logdose      1 115.56 115.562  6.8662 0.0193005 *
logd2        1   6.02   6.021  0.3577 0.5586917
type:logdose 1 138.06 138.062  8.2031 0.0118242 *
type:logd2   1   6.02   6.021  0.3577 0.5586917
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
            Df Sum Sq Mean Sq F value     Pr(>F)
bloc         3 538.79 179.597 10.6709 0.0005223 ***
type         1  12.04  12.042  0.7155 0.4109264
logdose      1   0.39   0.389  0.0231 0.8811262
logd2        1   6.02   6.021  0.3577 0.5586917
type:logdose 1   0.81   0.812  0.0483 0.8290541
type:logd2   1   6.02   6.021  0.3577 0.5586917
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
            Df Sum Sq Mean Sq F value     Pr(>F)
bloc         3 538.79 179.597 10.6709 0.0005223 ***
type         1  28.12  28.125  1.6711 0.2156736
logdose      1   0.39   0.389  0.0231 0.8811262
logd2        1   6.02   6.021  0.3577 0.5586917
type:logdose 1   0.81   0.812  0.0483 0.8290541
type:logd2   1   6.02   6.021  0.3577 0.5586917
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   50.792     2.5123 20.2175 2.697e-12 ***
bloc1          7.667     2.3686  3.2368  0.005531 **
bloc2         -3.500     2.3686 -1.4777  0.160183
bloc3         -4.333     2.3686 -1.8295  0.087270 .
bloc4          0.000     0.0000
type1          3.750     2.9009  1.2927  0.215674
type2          0.000     0.0000
logdose        1.375     5.2297  0.2629  0.796188
```

```
logd2              2.125     2.5123  0.8459  0.410926
type1:logdose     -1.625     7.3959 -0.2197  0.829054
type2:logdose      0.000     0.0000
type1:logd2       -2.125     3.5529 -0.5981  0.558692
type2:logd2        0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.6.9 p262 Output 7.28

```
 (47) MODEL
```

```
GLM(y ~ bloc + type + type:logdose, p256b)
```

```
$ANOVA
Response : y
                 Df  Sum Sq Mean Sq F value Pr(>F)
MODEL            8  816.50 102.063  6.0641 0.0014 **
RESIDUALS       15  252.46  16.831
CORRECTED TOTAL 23 1068.96
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
             Df Sum Sq Mean Sq F value     Pr(>F)
bloc          3 538.79 179.597 10.6709 0.0005223 ***
type          1  12.04  12.042  0.7155 0.4109264
type:logdose  4 265.67  66.417  3.9462 0.0220552 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
             Df Sum Sq Mean Sq F value     Pr(>F)
bloc          3 538.79 179.597 10.6709 0.0005223 ***
type          1  12.04  12.042  0.7155 0.4109264
type:logdose  4 265.67  66.417  3.9462 0.0220552 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
             Df Sum Sq Mean Sq F value     Pr(>F)
bloc          3 538.79 179.597 10.6709 0.0005223 ***
type          1  12.04  12.042  0.7155 0.4109264
type:logdose  4 265.67  66.417  3.9462 0.0220552 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
                Estimate Std. Error t value  Pr(>|t|)
(Intercept)       62.042     2.5123 24.6955 1.457e-13 ***
bloc1              7.667     2.3686  3.2368  0.005531 **
bloc2             -3.500     2.3686 -1.4777  0.160183
bloc3             -4.333     2.3686 -1.8295  0.087270 .
bloc4              0.000     0.0000
type1             -8.000     2.9009 -2.7578  0.014656 *
type2              0.000     0.0000
type1:logdose0     0.500     2.9009  0.1724  0.865459
type1:logdose1     0.250     2.9009  0.0862  0.932463
type1:logdose2     0.000     0.0000
type2:logdose0   -11.250     2.9009 -3.8781  0.001486 **
type2:logdose1    -7.750     2.9009 -2.6716  0.017423 *
type2:logdose2     0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.7 Chapter 8

5.7.1 p269

(48) MODEL

```
p269 = read.csv("C:/G/Rt/SAS4lm/fev1uni.csv")
p269 = af(p269, c("drug", "hour", "patient"))
GLM(fev1 ~ drug + patient %in% drug + hour + drug:hour, p269) # p271 Output 8.3
```

```
$ANOVA
Response : fev1
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           92 296.65  3.2244  51.078 < 2.2e-16 ***
RESIDUALS      483  30.49  0.0631
CORRECTED TOTAL 575 327.14
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
             Df  Sum Sq Mean Sq F value    Pr(>F)
drug          2  25.783 12.8913 204.212 < 2.2e-16 ***
drug:patient 69 247.412  3.5857  56.801 < 2.2e-16 ***
hour          7  17.170  2.4529  38.857 < 2.2e-16 ***
drug:hour    14   6.280  0.4486   7.106 1.923e-13 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
             Df  Sum Sq Mean Sq F value    Pr(>F)
drug          2   25.783 12.8913 204.212 < 2.2e-16 ***
drug:patient 69 247.412  3.5857  56.801 < 2.2e-16 ***
hour          7  17.170  2.4529  38.857 < 2.2e-16 ***
drug:hour    14   6.280  0.4486   7.106 1.923e-13 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
             Df  Sum Sq Mean Sq F value    Pr(>F)
drug          2   25.783 12.8913 204.212 < 2.2e-16 ***
drug:patient 69 247.412  3.5857  56.801 < 2.2e-16 ***
hour          7  17.170  2.4529  38.857 < 2.2e-16 ***
drug:hour    14   6.280  0.4486   7.106 1.923e-13 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
                   Estimate Std. Error  t value  Pr(>|t|)
(Intercept)         2.89349    0.10096  28.6606 < 2.2e-16 ***
druga               0.03458    0.14278   0.2422 0.8087105
drugc               0.63172    0.14278   4.4246 1.195e-05 ***
drugp               0.00000    0.00000
druga:patient201   -0.76375    0.12562  -6.0796 2.449e-09 ***
druga:patient202   -0.02375    0.12562  -0.1891 0.8501297
druga:patient203   -0.90875    0.12562  -7.2338 1.855e-12 ***
druga:patient204    0.31875    0.12562   2.5373 0.0114843 *
druga:patient205    0.32125    0.12562   2.5572 0.0108561 *
druga:patient206    0.20875    0.12562   1.6617 0.0972242 .
druga:patient207    0.00875    0.12562   0.0697 0.9444998
druga:patient208   -0.25500    0.12562  -2.0298 0.0429198 *
druga:patient209    0.31125    0.12562   2.4776 0.0135676 *
druga:patient210   -0.47500    0.12562  -3.7811 0.0001757 ***
druga:patient211    0.34375    0.12562   2.7363 0.0064421 **
druga:patient212   -1.29750    0.12562 -10.3283 < 2.2e-16 ***
druga:patient214    0.04125    0.12562   0.3284 0.7427837
druga:patient215    0.41000    0.12562   3.2637 0.0011777 **
druga:patient216    0.47250    0.12562   3.7612 0.0001899 ***
druga:patient217   -1.71625    0.12562 -13.6617 < 2.2e-16 ***
druga:patient218   -0.35000    0.12562  -2.7861 0.0055451 **
druga:patient219    0.07000    0.12562   0.5572 0.5776402
druga:patient220   -0.43875    0.12562  -3.4925 0.0005224 ***
druga:patient221    0.63125    0.12562   5.0249 7.106e-07 ***
druga:patient222   -0.04375    0.12562  -0.3483 0.7277982
druga:patient223    0.98500    0.12562   7.8408 2.887e-14 ***
druga:patient224    0.83625    0.12562   6.6567 7.624e-11 ***
```

```
druga:patient232  0.00000     0.00000
drugc:patient201 -0.53000     0.12562   -4.2189 2.933e-05 ***
drugc:patient202 -0.42250     0.12562   -3.3632 0.0008318 ***
drugc:patient203 -1.53375     0.12562  -12.2089 < 2.2e-16 ***
drugc:patient204 -0.21000     0.12562   -1.6716 0.0952434 .
drugc:patient205  0.32375     0.12562    2.5771 0.0102586 *
drugc:patient206  0.11750     0.12562    0.9353 0.3500901
drugc:patient207 -1.72750     0.12562  -13.7512 < 2.2e-16 ***
drugc:patient208 -0.43625     0.12562   -3.4726 0.0005617 ***
drugc:patient209 -0.25500     0.12562   -2.0298 0.0429198 *
drugc:patient210 -1.08250     0.12562   -8.6169 < 2.2e-16 ***
drugc:patient211 -0.74500     0.12562   -5.9303 5.765e-09 ***
drugc:patient212 -1.72375     0.12562  -13.7214 < 2.2e-16 ***
drugc:patient214 -0.68625     0.12562   -5.4627 7.522e-08 ***
drugc:patient215  0.09875     0.12562    0.7861 0.4322131
drugc:patient216  0.05375     0.12562    0.4279 0.6689439
drugc:patient217 -1.91875     0.12562  -15.2736 < 2.2e-16 ***
drugc:patient218 -0.78250     0.12562   -6.2288 1.023e-09 ***
drugc:patient219 -0.84875     0.12562   -6.7562 4.087e-11 ***
drugc:patient220 -1.01000     0.12562   -8.0398 7.105e-15 ***
drugc:patient221  0.23250     0.12562    1.8507 0.0648170 .
drugc:patient222 -0.60625     0.12562   -4.8259 1.873e-06 ***
drugc:patient223  0.96000     0.12562    7.6418 1.164e-13 ***
drugc:patient224  0.22750     0.12562    1.8109 0.0707711 .
drugc:patient232  0.00000     0.00000
drugp:patient201 -0.63250     0.12562   -5.0348 6.764e-07 ***
drugp:patient202 -0.04500     0.12562   -0.3582 0.7203440
drugp:patient203 -1.27250     0.12562  -10.1293 < 2.2e-16 ***
drugp:patient204  0.34750     0.12562    2.7662 0.0058894 **
drugp:patient205  0.60625     0.12562    4.8259 1.873e-06 ***
drugp:patient206  0.11500     0.12562    0.9154 0.3604275
drugp:patient207 -0.55875     0.12562   -4.4478 1.078e-05 ***
drugp:patient208 -0.57000     0.12562   -4.5373 7.199e-06 ***
drugp:patient209  0.35000     0.12562    2.7861 0.0055451 **
drugp:patient210 -0.36875     0.12562   -2.9353 0.0034909 **
drugp:patient211 -0.26375     0.12562   -2.0995 0.0362913 *
drugp:patient212 -1.18000     0.12562   -9.3930 < 2.2e-16 ***
drugp:patient214 -0.30625     0.12562   -2.4378 0.0151363 *
drugp:patient215 -0.06250     0.12562   -0.4975 0.6190549
drugp:patient216  0.24000     0.12562    1.9104 0.0566680 .
drugp:patient217 -1.80375     0.12562  -14.3582 < 2.2e-16 ***
drugp:patient218 -0.28750     0.12562   -2.2886 0.0225363 *
drugp:patient219 -0.14375     0.12562   -1.1443 0.2530759
drugp:patient220 -0.21125     0.12562   -1.6816 0.0932951 .
drugp:patient221  0.78375     0.12562    6.2388 9.646e-10 ***
drugp:patient222 -0.06500     0.12562   -0.5174 0.6051056
drugp:patient223  0.38000     0.12562    3.0249 0.0026199 **
drugp:patient224  0.79500     0.12562    6.3283 5.662e-10 ***
```

```
drugp:patient232    0.00000      0.00000
hour1               0.09458      0.07253    1.3041 0.1928336
hour2               0.16042      0.07253    2.2117 0.0274523 *
hour3               0.16583      0.07253    2.2864 0.0226619 *
hour4               0.13917      0.07253    1.9188 0.0556048 .
hour5               0.03625      0.07253    0.4998 0.6174473
hour6               0.08333      0.07253    1.1490 0.2511439
hour7               0.05250      0.07253    0.7238 0.4695140
hour8               0.00000      0.00000
druga:hour1         0.52083      0.10257    5.0777 5.464e-07 ***
druga:hour2         0.37833      0.10257    3.6884 0.0002513 ***
druga:hour3         0.16000      0.10257    1.5599 0.1194454
druga:hour4         0.04917      0.10257    0.4793 0.6319171
druga:hour5         0.15917      0.10257    1.5517 0.1213779
druga:hour6         0.03792      0.10257    0.3697 0.7118002
druga:hour7        -0.04208      0.10257   -0.4103 0.6817836
druga:hour8         0.00000      0.00000
drugc:hour1         0.58625      0.10257    5.7155 1.917e-08 ***
drugc:hour2         0.45583      0.10257    4.4440 1.096e-05 ***
drugc:hour3         0.40125      0.10257    3.9119 0.0001047 ***
drugc:hour4         0.29417      0.10257    2.8679 0.0043130 **
drugc:hour5         0.20292      0.10257    1.9783 0.0484656 *
drugc:hour6        -0.00833      0.10257   -0.0812 0.9352821
drugc:hour7        -0.08583      0.10257   -0.8368 0.4031156
drugc:hour8         0.00000      0.00000
drugp:hour1         0.00000      0.00000
drugp:hour2         0.00000      0.00000
drugp:hour3         0.00000      0.00000
drugp:hour4         0.00000      0.00000
drugp:hour5         0.00000      0.00000
drugp:hour6         0.00000      0.00000
drugp:hour7         0.00000      0.00000
drugp:hour8         0.00000      0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.8   Chapter 11

5.8.1   p390

(49) MODEL

```r
p390 = read.table("C:/G/Rt/SAS4lm/p390.txt", header=TRUE)
p390$ca = ifelse(p390$a == 0, -1, 1)
p390$cb = ifelse(p390$b == 0, -1, 1)
p390$cc = ifelse(p390$c == 0, -1, 1)
```

```
p390 = af(p390, c("rep", "blk", "a", "b", "c"))
GLM(y ~ rep/blk + ca*cb*cc, p390)
```

$ANOVA
Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	12	81.75	6.8125	33.601	6.618e-07 ***
RESIDUALS	11	2.23	0.2027		
CORRECTED TOTAL	23	83.98			

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	2	0.051	0.025	0.1256	0.8832237
rep:blk	3	7.432	2.477	12.2194	0.0007966 ***
ca	1	21.075	21.075	103.9487	6.090e-07 ***
cb	1	0.005	0.005	0.0224	0.8837872
ca:cb	1	1.723	1.723	8.4969	0.0140640 *
cc	1	37.776	37.776	186.3209	3.063e-08 ***
ca:cc	1	2.318	2.318	11.4332	0.0061285 **
cb:cc	1	11.340	11.340	55.9328	1.232e-05 ***
ca:cb:cc	1	0.031	0.031	0.1511	0.7049490

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	2	0.051	0.025	0.1256	0.883224
rep:blk	3	1.668	0.556	2.7416	0.093789 .
ca	1	21.075	21.075	103.9487	6.090e-07 ***
cb	1	0.005	0.005	0.0224	0.883787
ca:cb	1	1.723	1.723	8.4969	0.014064 *
cc	1	37.776	37.776	186.3209	3.063e-08 ***
ca:cc	1	2.318	2.318	11.4332	0.006129 **
cb:cc	1	11.340	11.340	55.9328	1.232e-05 ***
ca:cb:cc	1	0.031	0.031	0.1511	0.704949

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	2	0.051	0.025	0.1256	0.883224
rep:blk	3	1.668	0.556	2.7416	0.093789 .
ca	1	21.075	21.075	103.9487	6.090e-07 ***
cb	1	0.005	0.005	0.0224	0.883787
ca:cb	1	1.723	1.723	8.4969	0.014064 *

```
cc          1 37.776   37.776 186.3209 3.063e-08 ***
ca:cc       1  2.318    2.318  11.4332  0.006129 **
cb:cc       1 11.340   11.340  55.9328 1.232e-05 ***
ca:cb:cc    1  0.031    0.031   0.1511  0.704949
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
             Estimate Std. Error t value  Pr(>|t|)
(Intercept)   2.01062    0.25171  7.9879 6.627e-06 ***
rep1          0.32813    0.35597  0.9218  0.376420
rep2         -0.11000    0.35597 -0.3090  0.763085
rep3          0.00000    0.00000
rep1:blk1     0.20000    0.38995  0.5129  0.618170
rep1:blk2     0.00000    0.00000
rep2:blk1     0.87375    0.38995  2.2407  0.046645 *
rep2:blk2     0.00000    0.00000
rep3:blk1     0.66875    0.38995  1.7150  0.114346
rep3:blk2     0.00000    0.00000
ca            0.93708    0.09191 10.1955 6.090e-07 ***
cb            0.01375    0.09191  0.1496  0.883787
ca:cb        -0.26792    0.09191 -2.9149  0.014064 *
cc            1.25458    0.09191 13.6499 3.063e-08 ***
ca:cc         0.38062    0.11257  3.3813  0.006129 **
cb:cc        -0.84188    0.11257 -7.4788 1.232e-05 ***
ca:cb:cc     -0.04375    0.11257 -0.3887  0.704949
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.8.2 p394

(50) MODEL

```
p394 = read.table("C:/G/Rt/SAS4lm/p394.txt", header=TRUE)
p394 = af(p394, c("a", "b", "c", "d"))
GLM(y ~ ca*cb*cc*cd, p394)
```

```
$ANOVA
Response : y
                 Df Sum Sq Mean Sq F value Pr(>F)
MODEL             7 6.3559 0.90798
RESIDUALS         0 0.0000
CORRECTED TOTAL   7 6.3559


$`Type I`
             Df  Sum Sq Mean Sq F value Pr(>F)
```

```
ca              1 2.07061 2.07061
cb              1 0.59951 0.59951
ca:cb           1 0.00031 0.00031
cc              1 0.00551 0.00551
ca:cc           1 0.80011 0.80011
cb:cc           1 2.82031 2.82031
ca:cb:cc        1 0.05951 0.05951
cd              0
ca:cd           0
cb:cd           0
ca:cb:cd        0
cc:cd           0
ca:cc:cd        0
cb:cc:cd        0
ca:cb:cc:cd  0


$`Type II`
             Df Sum Sq Mean Sq F value Pr(>F)
ca              0
cb              0
ca:cb           0
cc              0
ca:cc           0
cb:cc           0
ca:cb:cc        0
cd              0
ca:cd           0
cb:cd           0
ca:cb:cd        0
cc:cd           0
ca:cc:cd        0
cb:cc:cd        0
ca:cb:cc:cd  0


$`Type III`
CAUTION: Singularity Exists !
             Df Sum Sq Mean Sq F value Pr(>F)
ca              0
cb              0
ca:cb           0
cc              0
ca:cc           0
cb:cc           0
ca:cb:cc        0
cd              0
ca:cd           0
cb:cd           0
ca:cb:cd     0
```

```
cc:cd          0
ca:cc:cd       0
cb:cc:cd       0
ca:cb:cc:cd    0

$Parameter
              Estimate Std. Error t value Pr(>|t|)
(Intercept)    2.68875
ca             0.50875
cb             0.27375
ca:cb         -0.00625
cc            -0.02625
ca:cc         -0.31625
cb:cc          0.59375
ca:cb:cc      -0.08625
cd             0.00000
ca:cd          0.00000
cb:cd          0.00000
ca:cb:cd       0.00000
cc:cd          0.00000
ca:cc:cd       0.00000
cb:cc:cd       0.00000
ca:cb:cc:cd    0.00000
```

 (51) MODEL

```
GLM(y ~ a*b*c*d, p394)
```

```
$ANOVA
Response : y
                 Df Sum Sq Mean Sq F value Pr(>F)
MODEL             7 6.3559 0.90798
RESIDUALS         0 0.0000
CORRECTED TOTAL   7 6.3559

$`Type I`
        Df  Sum Sq Mean Sq F value Pr(>F)
a        1 2.07061 2.07061
b        1 0.59951 0.59951
a:b      1 0.00031 0.00031
c        1 0.00551 0.00551
a:c      1 0.80011 0.80011
b:c      1 2.82031 2.82031
a:b:c    1 0.05951 0.05951
d        0
a:d      0
b:d      0
```

```
a:b:d    0
c:d      0
a:c:d    0
b:c:d    0
a:b:c:d  0


$`Type II`
        Df Sum Sq Mean Sq F value Pr(>F)
a         0
b         0
a:b       0
c         0
a:c       0
b:c       0
a:b:c     0
d         0
a:d       0
b:d       0
a:b:d     0
c:d       0
a:c:d     0
b:c:d     0
a:b:c:d   0


$`Type III`
CAUTION: Singularity Exists !
        Df Sum Sq Mean Sq F value Pr(>F)
a         0
b         0
a:b       0
c         0
a:c       0
b:c       0
a:b:c     0
d         0
a:d       0
b:d       0
a:b:d     0
c:d       0
a:c:d     0
b:c:d     0
a:b:c:d   0


$Parameter
           Estimate Std. Error t value Pr(>|t|)
(Intercept)    3.63
a0            -0.20
a1             0.00
```

```
b0              -1.55
b1               0.00
a0:b0           -0.37
a0:b1            0.00
a1:b0            0.00
a1:b1            0.00
c0              -0.33
c1               0.00
a0:c0           -1.61
a0:c1            0.00
a1:c0            0.00
a1:c1            0.00
b0:c0            2.03
b0:c1            0.00
b1:c0            0.00
b1:c1            0.00
a0:b0:c0         0.69
a0:b0:c1         0.00
a0:b1:c0         0.00
a0:b1:c1         0.00
a1:b0:c0         0.00
a1:b0:c1         0.00
a1:b1:c0         0.00
a1:b1:c1         0.00
d0               0.00
d1               0.00
a0:d0            0.00
a0:d1            0.00
a1:d0            0.00
a1:d1            0.00
b0:d0            0.00
b0:d1            0.00
b1:d0            0.00
b1:d1            0.00
a0:b0:d0         0.00
a0:b0:d1         0.00
a0:b1:d0         0.00
a0:b1:d1         0.00
a1:b0:d0         0.00
a1:b0:d1         0.00
a1:b1:d0         0.00
a1:b1:d1         0.00
c0:d0            0.00
c0:d1            0.00
c1:d0            0.00
c1:d1            0.00
a0:c0:d0         0.00
a0:c0:d1         0.00
```

```
a0:c1:d0          0.00
a0:c1:d1          0.00
a1:c0:d0          0.00
a1:c0:d1          0.00
a1:c1:d0          0.00
a1:c1:d1          0.00
b0:c0:d0          0.00
b0:c0:d1          0.00
b0:c1:d0          0.00
b0:c1:d1          0.00
b1:c0:d0          0.00
b1:c0:d1          0.00
b1:c1:d0          0.00
b1:c1:d1          0.00
a0:b0:c0:d0       0.00
a0:b0:c0:d1       0.00
a0:b0:c1:d0       0.00
a0:b0:c1:d1       0.00
a0:b1:c0:d0       0.00
a0:b1:c0:d1       0.00
a0:b1:c1:d0       0.00
a0:b1:c1:d1       0.00
a1:b0:c0:d0       0.00
a1:b0:c0:d1       0.00
a1:b0:c1:d0       0.00
a1:b0:c1:d1       0.00
a1:b1:c0:d0       0.00
a1:b1:c0:d1       0.00
a1:b1:c1:d0       0.00
a1:b1:c1:d1       0.00
```

5.8.3   p399

(52) MODEL

```
p399 = read.table("C:/G/Rt/SAS4lm/p399.txt", header=TRUE)
p399 = af(p399, c("blk", "trt"))
GLM(y ~ trt + blk, p399)
```

```
$ANOVA
Response : y
                Df  Sum Sq Mean Sq F value    Pr(>F)
MODEL            8 281.127  35.141  40.822 0.005606 **
RESIDUALS        3   2.583   0.861
CORRECTED TOTAL 11 283.710
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
    Df Sum Sq Mean Sq F value    Pr(>F)
trt  3 102.26  34.086  39.596 0.006515 **
blk  5 178.87  35.774  41.558 0.005691 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
    Df  Sum Sq Mean Sq F value    Pr(>F)
trt  3  59.018  19.673  22.853 0.014388 *
blk  5 178.871  35.774  41.558 0.005691 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
    Df  Sum Sq Mean Sq F value    Pr(>F)
trt  3  59.017  19.672  22.853 0.014388 *
blk  5 178.871  35.774  41.558 0.005691 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error  t value   Pr(>|t|)
(Intercept)  19.1375    1.03732  18.4489 0.0003475 ***
trt1         -6.8250    0.92781  -7.3560 0.0051925 **
trt2         -5.9750    0.92781  -6.4399 0.0075922 **
trt3         -2.7000    0.92781  -2.9101 0.0619928 .
trt4          0.0000    0.00000
blk1        -10.7875    1.03732 -10.3994 0.0018975 **
blk2         -9.9375    1.03732  -9.5799 0.0024133 **
blk3         -5.9750    1.03732  -5.7600 0.0103986 *
blk4         -4.2000    1.03732  -4.0489 0.0271308 *
blk5         -2.1750    1.13633  -1.9141 0.1515206
blk6          0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.8.4 p403

(53) MODEL

```r
p403 = read.table("C:/G/Rt/SAS4lm/p403.txt", header=TRUE)
p403 = af(p403, c("PATIENT", "VISIT"))
GLM(HR ~ SEQUENCE + PATIENT %in% SEQUENCE + VISIT + DRUG + RESIDS + RESIDT, p403)
```

```
$ANOVA
Response : HR
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           29 6408.7  220.99   3.912 3.127e-05 ***
RESIDUALS       42 2372.6   56.49
CORRECTED TOTAL 71 8781.3
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
                Df Sum Sq Mean Sq F value   Pr(>F)
SEQUENCE         5  508.9  101.79  1.8019 0.133346
SEQUENCE:PATIENT 18 4692.3  260.69  4.6147 2.21e-05 ***
VISIT            2  146.8   73.39  1.2991 0.283499
DRUG             2  668.8  334.39  5.9194 0.005435 **
RESIDS           1  391.0  391.02  6.9219 0.011854 *
RESIDT           1    0.8    0.84  0.0149 0.903511
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
                Df Sum Sq Mean Sq F value   Pr(>F)
SEQUENCE         5  701.2 140.237  2.4825  0.04665 *
SEQUENCE:PATIENT 18 4692.3 260.685  4.6147 2.21e-05 ***
VISIT            2  146.8  73.389  1.2991  0.28350
DRUG             2  344.0 171.975  3.0443  0.05826 .
RESIDS           1  309.2 309.174  5.4731  0.02414 *
RESIDT           1    0.8   0.840  0.0149  0.90351
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
                Df Sum Sq Mean Sq F value   Pr(>F)
SEQUENCE         5  701.2 140.237  2.4825  0.04665 *
SEQUENCE:PATIENT 18 4692.3 260.685  4.6147 2.21e-05 ***
VISIT            2  146.8  73.389  1.2991  0.28350
DRUG             2  343.9 171.975  3.0443  0.05826 .
RESIDS           1  309.2 309.174  5.4731  0.02414 *
RESIDT           1    0.8   0.840  0.0149  0.90351
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
                Estimate Std. Error t value  Pr(>|t|)
(Intercept)       69.333     4.7287 14.6622 < 2.2e-16 ***
SEQUENCEA         -4.458     6.2319 -0.7154 0.4783191
SEQUENCEB         12.667     6.1368  2.0641 0.0452254 *
SEQUENCEC          4.854     6.2319  0.7789 0.4403943
```

```
SEQUENCED               24.187      6.2319  3.8812 0.0003609 ***
SEQUENCEE               12.875      6.2319  2.0660 0.0450354 *
SEQUENCEF                0.000      0.0000
SEQUENCEA:PATIENT1       0.000      0.0000
SEQUENCEA:PATIENT10      0.000      0.0000
SEQUENCEA:PATIENT11      0.000      0.0000
SEQUENCEA:PATIENT12      0.000      0.0000
SEQUENCEA:PATIENT13      0.000      0.0000
SEQUENCEA:PATIENT14      0.000      0.0000
SEQUENCEA:PATIENT15     16.000      6.1368  2.6072 0.0125823 *
SEQUENCEA:PATIENT16      0.000      0.0000
SEQUENCEA:PATIENT17     29.333      6.1368  4.7799 2.168e-05 ***
SEQUENCEA:PATIENT18      0.000      0.0000
SEQUENCEA:PATIENT19      0.000      0.0000
SEQUENCEA:PATIENT2       0.000      0.0000
SEQUENCEA:PATIENT20      0.000      0.0000
SEQUENCEA:PATIENT21      0.000      0.0000
SEQUENCEA:PATIENT22      0.000      0.0000
SEQUENCEA:PATIENT23      0.000      0.0000
SEQUENCEA:PATIENT24      0.000      0.0000
SEQUENCEA:PATIENT3       0.000      0.0000
SEQUENCEA:PATIENT4       0.000      0.0000
SEQUENCEA:PATIENT5       0.000      0.0000
SEQUENCEA:PATIENT6       0.000      0.0000
SEQUENCEA:PATIENT7      25.333      6.1368  4.1281 0.0001697 ***
SEQUENCEA:PATIENT8       0.000      0.0000
SEQUENCEA:PATIENT9       0.000      0.0000
SEQUENCEB:PATIENT1      10.667      6.1368  1.7382 0.0895112 .
SEQUENCEB:PATIENT10      0.000      0.0000
SEQUENCEB:PATIENT11      0.000      0.0000
SEQUENCEB:PATIENT12      0.000      0.0000
SEQUENCEB:PATIENT13      0.000      0.0000
SEQUENCEB:PATIENT14      0.000      0.0000
SEQUENCEB:PATIENT15      0.000      0.0000
SEQUENCEB:PATIENT16      0.000      0.0000
SEQUENCEB:PATIENT17      0.000      0.0000
SEQUENCEB:PATIENT18      0.000      0.0000
SEQUENCEB:PATIENT19      0.000      0.0000
SEQUENCEB:PATIENT2       0.000      0.0000
SEQUENCEB:PATIENT20    -13.333      6.1368 -2.1727 0.0354954 *
SEQUENCEB:PATIENT21      0.000      0.0000
SEQUENCEB:PATIENT22      0.000      0.0000
SEQUENCEB:PATIENT23      0.000      0.0000
SEQUENCEB:PATIENT24      0.000      0.0000
SEQUENCEB:PATIENT3       4.000      6.1368  0.6518 0.5180764
SEQUENCEB:PATIENT4       0.000      0.0000
SEQUENCEB:PATIENT5       0.000      0.0000
SEQUENCEB:PATIENT6       0.000      0.0000
```

```
SEQUENCEB:PATIENT7      0.000      0.0000
SEQUENCEB:PATIENT8      0.000      0.0000
SEQUENCEB:PATIENT9      0.000      0.0000
SEQUENCEC:PATIENT1      0.000      0.0000
SEQUENCEC:PATIENT10     2.667      6.1368   0.4345 0.6661219
SEQUENCEC:PATIENT11     0.000      0.0000
SEQUENCEC:PATIENT12     0.000      0.0000
SEQUENCEC:PATIENT13     0.000      0.0000
SEQUENCEC:PATIENT14     0.000      0.0000
SEQUENCEC:PATIENT15     0.000      0.0000
SEQUENCEC:PATIENT16     0.000      0.0000
SEQUENCEC:PATIENT17     0.000      0.0000
SEQUENCEC:PATIENT18     0.000      0.0000
SEQUENCEC:PATIENT19     0.000      0.0000
SEQUENCEC:PATIENT2      0.000      0.0000
SEQUENCEC:PATIENT20     0.000      0.0000
SEQUENCEC:PATIENT21     22.667     6.1368   3.6936 0.0006327 ***
SEQUENCEC:PATIENT22     13.333     6.1368   2.1727 0.0354954 *
SEQUENCEC:PATIENT23     0.000      0.0000
SEQUENCEC:PATIENT24     0.000      0.0000
SEQUENCEC:PATIENT3      0.000      0.0000
SEQUENCEC:PATIENT4      0.000      0.0000
SEQUENCEC:PATIENT5      0.000      0.0000
SEQUENCEC:PATIENT6      0.000      0.0000
SEQUENCEC:PATIENT7      0.000      0.0000
SEQUENCEC:PATIENT8      0.000      0.0000
SEQUENCEC:PATIENT9      0.000      0.0000
SEQUENCED:PATIENT1      0.000      0.0000
SEQUENCED:PATIENT10     0.000      0.0000
SEQUENCED:PATIENT11     0.000      0.0000
SEQUENCED:PATIENT12     0.000      0.0000
SEQUENCED:PATIENT13     -6.667     6.1368 -1.0863 0.2835215
SEQUENCED:PATIENT14     0.000      0.0000
SEQUENCED:PATIENT15     0.000      0.0000
SEQUENCED:PATIENT16     0.000      0.0000
SEQUENCED:PATIENT17     0.000      0.0000
SEQUENCED:PATIENT18     0.000      0.0000
SEQUENCED:PATIENT19     0.000      0.0000
SEQUENCED:PATIENT2      0.000      0.0000
SEQUENCED:PATIENT20     0.000      0.0000
SEQUENCED:PATIENT21     0.000      0.0000
SEQUENCED:PATIENT22     0.000      0.0000
SEQUENCED:PATIENT23     0.000      0.0000
SEQUENCED:PATIENT24     -7.333     6.1368 -1.1950 0.2387989
SEQUENCED:PATIENT3      0.000      0.0000
SEQUENCED:PATIENT4      -1.333     6.1368 -0.2173 0.8290506
SEQUENCED:PATIENT5      0.000      0.0000
SEQUENCED:PATIENT6      0.000      0.0000
```

```
SEQUENCED:PATIENT7     0.000     0.0000
SEQUENCED:PATIENT8     0.000     0.0000
SEQUENCED:PATIENT9     0.000     0.0000
SEQUENCEE:PATIENT1     0.000     0.0000
SEQUENCEE:PATIENT10    0.000     0.0000
SEQUENCEE:PATIENT11    0.000     0.0000
SEQUENCEE:PATIENT12   12.000     6.1368   1.9554 0.0572081 .
SEQUENCEE:PATIENT13    0.000     0.0000
SEQUENCEE:PATIENT14    0.000     0.0000
SEQUENCEE:PATIENT15    0.000     0.0000
SEQUENCEE:PATIENT16   13.333     6.1368   2.1727 0.0354954 *
SEQUENCEE:PATIENT17    0.000     0.0000
SEQUENCEE:PATIENT18    0.000     0.0000
SEQUENCEE:PATIENT19   -0.667     6.1368  -0.1086 0.9140096
SEQUENCEE:PATIENT2     0.000     0.0000
SEQUENCEE:PATIENT20    0.000     0.0000
SEQUENCEE:PATIENT21    0.000     0.0000
SEQUENCEE:PATIENT22    0.000     0.0000
SEQUENCEE:PATIENT23    0.000     0.0000
SEQUENCEE:PATIENT24    0.000     0.0000
SEQUENCEE:PATIENT3     0.000     0.0000
SEQUENCEE:PATIENT4     0.000     0.0000
SEQUENCEE:PATIENT5     0.000     0.0000
SEQUENCEE:PATIENT6     0.000     0.0000
SEQUENCEE:PATIENT7     0.000     0.0000
SEQUENCEE:PATIENT8     0.000     0.0000
SEQUENCEE:PATIENT9     0.000     0.0000
SEQUENCEF:PATIENT1     0.000     0.0000
SEQUENCEF:PATIENT10    0.000     0.0000
SEQUENCEF:PATIENT11   10.667     6.1368   1.7382 0.0895112 .
SEQUENCEF:PATIENT12    0.000     0.0000
SEQUENCEF:PATIENT13    0.000     0.0000
SEQUENCEF:PATIENT14   16.667     6.1368   2.7159 0.0095552 **
SEQUENCEF:PATIENT15    0.000     0.0000
SEQUENCEF:PATIENT16    0.000     0.0000
SEQUENCEF:PATIENT17    0.000     0.0000
SEQUENCEF:PATIENT18   18.667     6.1368   3.0418 0.0040426 **
SEQUENCEF:PATIENT19    0.000     0.0000
SEQUENCEF:PATIENT2     0.000     0.0000
SEQUENCEF:PATIENT20    0.000     0.0000
SEQUENCEF:PATIENT21    0.000     0.0000
SEQUENCEF:PATIENT22    0.000     0.0000
SEQUENCEF:PATIENT23    0.000     0.0000
SEQUENCEF:PATIENT24    0.000     0.0000
SEQUENCEF:PATIENT3     0.000     0.0000
SEQUENCEF:PATIENT4     0.000     0.0000
SEQUENCEF:PATIENT5     0.000     0.0000
SEQUENCEF:PATIENT6     0.000     0.0000
```

```
SEQUENCEF:PATIENT7     0.000     0.0000
SEQUENCEF:PATIENT8     0.000     0.0000
SEQUENCEF:PATIENT9     0.000     0.0000
VISIT2                -2.583     2.1697 -1.1907 0.2404762
VISIT3                 0.750     2.1697  0.3457 0.7313138
VISIT4                 0.000     0.0000
DRUGplacebo           -5.938     2.4258 -2.4477 0.0186398 *
DRUGstandard          -3.625     2.4258 -1.4944 0.1425553
DRUGtest               0.000     0.0000
RESIDS                -4.396     1.8790 -2.3395 0.0241414 *
RESIDT                 0.229     1.8790  0.1220 0.9035106
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(54) MODEL

```
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(HR ~ SEQUENCE + PATIENT %in% SEQUENCE + VISIT + DRUG + RESIDS + RESIDT,
         p403), type=3, singular.ok=TRUE) # NOT OK
```

```
Note: model has aliased coefficients
      sums of squares computed by model comparison


Anova Table (Type III tests)

Response: HR
                Sum Sq Df F values    Pr(>F)
SEQUENCE           0.0  0
VISIT            146.8  2   1.2991   0.28350
DRUG             344.0  2   3.0443   0.05826 .
RESIDS           309.2  1   5.4731   0.02414 *
RESIDT             0.8  1   0.0149   0.90351
SEQUENCE:PATIENT 4692.3 18   4.6147 2.21e-05 ***
Residuals       2372.6 42
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.8.5   p409 11.5

(55) MODEL

```
p409 = read.table("C:/G/Rt/SAS4lm/p409.txt", header=TRUE)
GLM(TS ~ SOURCE*AMT, p409) # p410 Output 11.21
```

```
$ANOVA
```

```
Response : TS
                Df  Sum Sq Mean Sq F value    Pr(>F)
MODEL           5 258.727  51.745  263.71 1.785e-09 ***
RESIDUALS       9   1.766   0.196
CORRECTED TOTAL 14 260.493
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
          Df  Sum Sq Mean Sq F value    Pr(>F)
SOURCE     2  98.001  49.001 249.720 1.306e-08 ***
AMT        1 138.245 138.245 704.534 7.392e-10 ***
SOURCE:AMT 2  22.481  11.240  57.284 7.595e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
          Df  Sum Sq Mean Sq F value    Pr(>F)
SOURCE     2  98.001  49.001 249.720 1.306e-08 ***
AMT        1 138.245 138.245 704.534 7.392e-10 ***
SOURCE:AMT 2  22.481  11.240  57.284 7.595e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
          Df  Sum Sq Mean Sq F value    Pr(>F)
SOURCE     2   0.070   0.035   0.179     0.839
AMT        1 138.245 138.245 704.534 7.392e-10 ***
SOURCE:AMT 2  22.481  11.240  57.284 7.595e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error  t value  Pr(>|t|)
(Intercept)     9.49    0.46459  20.4266 7.537e-09 ***
SOURCEA         0.33    0.65703   0.5023    0.6275
SOURCEB        -0.02    0.65703  -0.0304    0.9764
SOURCEC         0.00    0.00000
AMT             3.35    0.14008  23.9150 1.867e-09 ***
SOURCEA:AMT    -1.61    0.19810  -8.1271 1.951e-05 ***
SOURCEB:AMT    -2.00    0.19810 -10.0958 3.305e-06 ***
SOURCEC:AMT     0.00    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.8.6 p412

(56) MODEL

```
p412 = read.table("C:/G/Rt/SAS4lm/p412.txt", header=TRUE)
GLM(ts ~ source:amt, p412) # p413 Output 11.24
```

```
$ANOVA
Response : ts
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            3 393.01 131.002  903.34 < 2.2e-16 ***
RESIDUALS       16   2.32   0.145
CORRECTED TOTAL 19 395.33
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
          Df Sum Sq Mean Sq F value    Pr(>F)
source:amt 3 393.01     131  903.34 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
          Df Sum Sq Mean Sq F value    Pr(>F)
source:amt 3 393.01     131  903.34 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
          Df Sum Sq Mean Sq F value    Pr(>F)
source:amt 3 393.01     131  903.34 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   9.8824   0.136994  72.137 < 2.2e-16 ***
sourceA:amt   1.7230   0.063503  27.133 8.438e-15 ***
sourceB:amt   1.2375   0.063503  19.488 1.427e-12 ***
sourceC:amt   3.2430   0.063503  51.068 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.8.7 p414

(57) MODEL

98

```
p414 = read.table("C:/G/Rt/SAS4lm/p414.txt", header=TRUE)
p414 = af(p414, c("lackofit"))
GLM(loglivcu ~ level + lackofit, p414) # p415 Output 11.26
```

$ANOVA
Response : loglivcu
                 Df Sum Sq Mean Sq F value   Pr(>F)
MODEL   3 5.2310 1.74365 155.47 5.018e-14 ***
RESIDUALS   20 0.2243 0.01122
CORRECTED TOTAL 23 5.4553

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
          Df Sum Sq Mean Sq F value   Pr(>F)
level   1 4.9859 4.9859 444.555 3.997e-15 ***
lackofit   2 0.2450 0.1225 10.924 0.0006216 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
          Df Sum Sq Mean Sq F value   Pr(>F)
level   0
lackofit   2 0.24504 0.12252 10.924 0.0006216 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
CAUTION: Singularity Exists !
          Df Sum Sq Mean Sq F value   Pr(>F)
level   0
lackofit   2 0.24504 0.12252 10.924 0.0006216 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   1.41347   0.155886 9.0674 1.598e-08 ***
level   0.00210   0.000408 5.1443 4.937e-05 ***
lackofit0   -0.19544   0.161770 -1.2081 0.241091
lackofit150 -0.34501   0.105903 -3.2578 0.003939 **
lackofit300   0.00000   0.000000
lackofit450   0.00000   0.000000

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.8.8 p417

(58) MODEL

```
p417 = read.table("C:/G/Rt/SAS4lm/p417.txt", header=TRUE)
p417 = af(p417, c("TRT", "POT", "PLANT"))
GLM(Y ~ TRT + POT %in% TRT, p417) # p418 Output 11.28
```

```
$ANOVA
Response : Y
                Df  Sum Sq Mean Sq F value    Pr(>F)
MODEL            7 267.226  38.175  12.433 7.522e-05 ***
RESIDUALS       13  39.917   3.071
CORRECTED TOTAL 20 307.143
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
        Df  Sum Sq Mean Sq F value    Pr(>F)
TRT      2 236.921 118.460  38.580 3.412e-06 ***
TRT:POT  5  30.306   6.061   1.974    0.1499
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
        Df  Sum Sq Mean Sq F value    Pr(>F)
TRT      2 236.921 118.460  38.580 3.412e-06 ***
TRT:POT  5  30.306   6.061   1.974    0.1499
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
        Df  Sum Sq Mean Sq F value    Pr(>F)
TRT      2 200.111 100.055  32.586 8.626e-06 ***
TRT:POT  5  30.306   6.061   1.974    0.1499
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)  12.0000    0.78365 15.3130 1.070e-09 ***
TRT1          0.0000    1.91954  0.0000   1.00000
TRT2          8.2500    1.17547  7.0185 9.087e-06 ***
TRT3          0.0000    0.00000
TRT1:POT1     2.6667    2.02337  1.3179   0.21028
TRT1:POT2     6.0000    2.14611  2.7958   0.01515 *
TRT1:POT3     0.0000    0.00000
```

100

```
TRT2:POT1     0.2500    1.51753  0.1647   0.87168
TRT2:POT2     0.0000    0.00000
TRT2:POT3     0.0000    0.00000
TRT3:POT1     1.0000    1.27969  0.7814   0.44854
TRT3:POT2    -1.0000    1.91954 -0.5210   0.61115
TRT3:POT3     0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(Y ~ TRT + POT %in% TRT, p417), type=3, singular.ok=TRUE) # NOT OK
```

```
Note: model has aliased coefficients
      sums of squares computed by model comparison


Anova Table (Type III tests)

Response: Y
          Sum Sq Df F values  Pr(>F)
TRT       22.310  1    7.266 0.01835 *
TRT:POT   30.306  5    1.974 0.14991
Residuals 39.917 13
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.8.9 p431

(59) MODEL

```
p431 = read.table("C:/G/Rt/SAS4lm/p431.txt", header=TRUE)
p431 = af(p431, c("line", "sire", "agedam", "steerno"))
GLM(avdlygn ~ line + line:sire + agedam + line:agedam + age + intlwt, p431)
```

```
$ANOVA
Response : avdlygn
                Df Sum Sq  Mean Sq F value   Pr(>F)
MODEL           16 2.5275 0.157966  3.1437 0.001091 **
RESIDUALS       48 2.4119 0.050248
CORRECTED TOTAL 64 4.9394
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
          Df  Sum Sq  Mean Sq F value  Pr(>F)
line       2 0.38009 0.190046  3.7821 0.02983 *
```

```
line:sire      6 0.92634 0.154391   3.0726 0.01260 *
agedam         2 0.11894 0.059471   1.1835 0.31497
line:agedam    4 0.64889 0.162222   3.2284 0.02000 *
age            1 0.18349 0.183487   3.6516 0.06200 .
intlwt         1 0.26970 0.269704   5.3674 0.02483 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
            Df  Sum Sq Mean Sq F value   Pr(>F)
line         2 0.05526 0.02763  0.5498 0.580636
line:sire    6 0.97389 0.16231  3.2303 0.009543 **
agedam       2 0.33106 0.16553  3.2943 0.045640 *
line:agedam  4 0.45343 0.11336  2.2560 0.076821 .
age          1 0.38128 0.38128  7.5878 0.008277 **
intlwt       1 0.26970 0.26970  5.3674 0.024830 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
            Df  Sum Sq Mean Sq F value   Pr(>F)
line         2 0.13620 0.06810  1.3553 0.267560
line:sire    6 0.97389 0.16231  3.2303 0.009543 **
agedam       2 0.13011 0.06505  1.2946 0.283392
line:agedam  4 0.45343 0.11336  2.2560 0.076821 .
age          1 0.38128 0.38128  7.5878 0.008277 **
intlwt       1 0.26970 0.26970  5.3674 0.024830 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
             Estimate Std. Error t value  Pr(>|t|)
(Intercept)   2.99627    0.51285  5.8423 4.361e-07 ***
line1         0.07182    0.14551  0.4936  0.623826
line2         0.25247    0.13717  1.8406  0.071867 .
line3         0.00000    0.00000
line1:sire1   0.08573    0.13028  0.6580  0.513652
line1:sire2  -0.12171    0.13622 -0.8934  0.376079
line1:sire3   0.00000    0.00000
line1:sire4   0.00000    0.00000
line1:sire5   0.00000    0.00000
line1:sire6   0.00000    0.00000
line1:sire7   0.00000    0.00000
line1:sire8   0.00000    0.00000
line1:sire9   0.00000    0.00000
line2:sire1   0.00000    0.00000
line2:sire2   0.00000    0.00000
line2:sire3   0.00000    0.00000
```

```
line2:sire4    -0.24460     0.12669 -1.9307  0.059443 .
line2:sire5     0.00000     0.00000
line2:sire6     0.00000     0.00000
line2:sire7     0.00000     0.00000
line2:sire8     0.00000     0.00000
line2:sire9     0.00000     0.00000
line3:sire1     0.00000     0.00000
line3:sire2     0.00000     0.00000
line3:sire3     0.00000     0.00000
line3:sire4     0.00000     0.00000
line3:sire5     0.00000     0.00000
line3:sire6     0.10540     0.12909  0.8165  0.418267
line3:sire7    -0.01952     0.12038 -0.1622  0.871856
line3:sire8    -0.33024     0.12567 -2.6278  0.011504 *
line3:sire9     0.00000     0.00000
agedam3         0.37039     0.11456  3.2332  0.002216 **
agedam4         0.27546     0.10378  2.6544  0.010746 *
agedam5         0.00000     0.00000
line1:agedam3 -0.44894     0.19581 -2.2927  0.026291 *
line1:agedam4 -0.28283     0.16085 -1.7584  0.085062 .
line1:agedam5  0.00000     0.00000
line2:agedam3 -0.26078     0.19529 -1.3354  0.188050
line2:agedam4 -0.35026     0.17439 -2.0085  0.050232 .
line2:agedam5  0.00000     0.00000
line3:agedam3  0.00000     0.00000
line3:agedam4  0.00000     0.00000
line3:agedam5  0.00000     0.00000
age            -0.00853     0.00310 -2.7546  0.008277 **
intlwt          0.00203     0.00087  2.3168  0.024830 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

 # p433 Output 11.40

```
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(avdlygn ~ line + line:sire + agedam + line:agedam + age + intlwt, p431),
      type=3, singular.ok=TRUE) # NOT OK for line
```

```
Note: model has aliased coefficients
      sums of squares computed by model comparison


Anova Table (Type III tests)

Response: avdlygn
            Sum Sq Df F values   Pr(>F)
line        0.00000  0
```

```
agedam      0.13011  2   1.2946 0.283392
age         0.38128  1   7.5878 0.008277 **
intlwt      0.26970  1   5.3674 0.024830 *
line:sire   0.97389  6   3.2303 0.009543 **
line:agedam 0.45343  4   2.2560 0.076821 .
Residuals   2.41192 48
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

 (60) MODEL

```
GLM(avdlygn ~ sire + agedam, p431) # # p434 Output 11.41
```

```
$ANOVA
Response : avdlygn
                Df Sum Sq  Mean Sq F value  Pr(>F)
MODEL           10 1.4254 0.142538  2.1904 0.03237 *
RESIDUALS       54 3.5140 0.065074
CORRECTED TOTAL 64 4.9394
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
       Df  Sum Sq  Mean Sq F value  Pr(>F)
sire    8 1.30644 0.163305  2.5095 0.02138 *
agedam  2 0.11894 0.059471  0.9139 0.40707
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
       Df  Sum Sq  Mean Sq F value  Pr(>F)
sire    8 1.33017 0.166271  2.5551 0.01937 *
agedam  2 0.11894 0.059471  0.9139 0.40707
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
       Df  Sum Sq  Mean Sq F value  Pr(>F)
sire    8 1.33017 0.166271  2.5551 0.01937 *
agedam  2 0.11894 0.059471  0.9139 0.40707
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  2.46347   0.096216 25.6036  < 2e-16 ***
sire1       -0.00739   0.128186 -0.0576  0.95427
```

```
sire2         -0.21429   0.128606 -1.6662   0.10146
sire3         -0.02260   0.146050 -0.1548   0.87759
sire4         -0.02364   0.128186 -0.1844   0.85440
sire5          0.12311   0.132193  0.9313   0.35585
sire6         -0.05290   0.138320 -0.3824   0.70364
sire7         -0.14760   0.129061 -1.1436   0.25782
sire8         -0.40781   0.135054 -3.0196   0.00386 **
sire9          0.00000   0.000000
agedam3        0.11738   0.089117  1.3172   0.19334
agedam4        0.04830   0.077154  0.6260   0.53395
agedam5        0.00000   0.000000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.8.10   p437 ABSORB option in SAS

(61) MODEL

```
GLM(avdlygn ~ line + sire + agedam + line:agedam + age + intlwt, p431)
```

```
$ANOVA
Response : avdlygn
                Df Sum Sq  Mean Sq F value   Pr(>F)
MODEL           16 2.5275 0.157966  3.1437 0.001091 **
RESIDUALS       48 2.4119 0.050248
CORRECTED TOTAL 64 4.9394
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
            Df  Sum Sq  Mean Sq F value  Pr(>F)
line         2 0.38009 0.190046  3.7821 0.02983 *
sire         6 0.92634 0.154391  3.0726 0.01260 *
agedam       2 0.11894 0.059471  1.1835 0.31497
line:agedam  4 0.64889 0.162222  3.2284 0.02000 *
age          1 0.18349 0.183487  3.6516 0.06200 .
intlwt       1 0.26970 0.269704  5.3674 0.02483 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
            Df  Sum Sq Mean Sq F value   Pr(>F)
line         0
sire         6 0.97389 0.16231  3.2303 0.009543 **
agedam       2 0.33106 0.16553  3.2943 0.045640 *
line:agedam  4 0.45343 0.11336  2.2560 0.076821 .
```

105

```
age            1 0.38128 0.38128   7.5878 0.008277 **
intlwt         1 0.26970 0.26970   5.3674 0.024830 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
CAUTION: Singularity Exists !
            Df   Sum Sq Mean Sq F value    Pr(>F)
line         0
sire         6 0.97389 0.16231   3.2303 0.009543 **
agedam       2 0.13011 0.06505   1.2946 0.283392
line:agedam  4 0.45343 0.11336   2.2560 0.076821 .
age          1 0.38128 0.38128   7.5878 0.008277 **
intlwt       1 0.26970 0.26970   5.3674 0.024830 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
              Estimate Std. Error t value  Pr(>|t|)
(Intercept)    2.99627    0.51285  5.8423 4.361e-07 ***
line1          0.07182    0.14551  0.4936  0.623826
line2          0.25247    0.13717  1.8406  0.071867 .
line3          0.00000    0.00000
sire1          0.08573    0.13028  0.6580  0.513652
sire2         -0.12171    0.13622 -0.8934  0.376079
sire3          0.00000    0.00000
sire4         -0.24460    0.12669 -1.9307  0.059443 .
sire5          0.00000    0.00000
sire6          0.10540    0.12909  0.8165  0.418267
sire7         -0.01952    0.12038 -0.1622  0.871856
sire8         -0.33024    0.12567 -2.6278  0.011504 *
sire9          0.00000    0.00000
agedam3        0.37039    0.11456  3.2332  0.002216 **
agedam4        0.27546    0.10378  2.6544  0.010746 *
agedam5        0.00000    0.00000
line1:agedam3 -0.44894    0.19581 -2.2927  0.026291 *
line1:agedam4 -0.28283    0.16085 -1.7584  0.085062 .
line1:agedam5  0.00000    0.00000
line2:agedam3 -0.26078    0.19529 -1.3354  0.188050
line2:agedam4 -0.35026    0.17439 -2.0085  0.050232 .
line2:agedam5  0.00000    0.00000
line3:agedam3  0.00000    0.00000
line3:agedam4  0.00000    0.00000
line3:agedam5  0.00000    0.00000
age           -0.00853    0.00310 -2.7546  0.008277 **
intlwt         0.00203    0.00087  2.3168  0.024830 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# p437 Output 11.43
```

6 Sahai - Unbalanced

Reference

- Sahai H, Ojeda MM. Analysis of Variance for Random Models Volume 2 Unbalanced Data. 2005.

6.1 Table 11.2

(62) MODEL

```
T11.2 = read.table("C:/G/Rt/ANOVA/T11.2.txt")
colnames(T11.2) = c("Group", "Y")
T11.2 = af(T11.2, "Group")
GLM(Y ~ Group, T11.2) # p115
```

```
$ANOVA
Response : Y
                Df  Sum Sq Mean Sq F value     Pr(>F)
MODEL            4  80.401 20.1003  5.9884 0.0004103 ***
RESIDUALS       59 198.036  3.3565
CORRECTED TOTAL 63 278.438
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
      Df Sum Sq Mean Sq F value     Pr(>F)
Group  4 80.401    20.1  5.9884 0.0004103 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
      Df Sum Sq Mean Sq F value     Pr(>F)
Group  4 80.401    20.1  5.9884 0.0004103 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
      Df Sum Sq Mean Sq F value     Pr(>F)
Group  4 80.401    20.1  5.9884 0.0004103 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error  t value  Pr(>|t|)
(Intercept)   66.133    0.47304 139.8040 < 2.2e-16 ***
Group1        -2.952    0.72726  -4.0584 0.0001473 ***
```

```
Group2         -2.508    0.80208  -3.1273 0.0027390 **
Group3         -1.967    0.88498  -2.2223 0.0301120 *
Group4         -2.592    0.60301  -4.2979 6.547e-05 ***
Group5          0.000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

6.2 Table 12.6

(63) MODEL

```
T12.6 = read.table("C:/G/Rt/ANOVA/T12.6.txt")
colnames(T12.6) = c("Location", "Family", "Y")
T12.6 = af(T12.6, c("Location", "Family"))
GLM(Y ~ Location + Family, T12.6) # p184
```

```
$ANOVA
Response : Y
                Df Sum Sq  Mean Sq F value    Pr(>F)
MODEL            7 1.6144 0.230636  8.9562 7.223e-07 ***
RESIDUALS       45 1.1588 0.025752
CORRECTED TOTAL 52 2.7733
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
         Df  Sum Sq Mean Sq F value    Pr(>F)
Location  3 0.74036 0.24679  9.5833 5.219e-05 ***
Family    4 0.87410 0.21852  8.4859 3.436e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
         Df  Sum Sq Mean Sq F value    Pr(>F)
Location  3 0.83765 0.27921 10.8426 1.753e-05 ***
Family    4 0.87410 0.21852  8.4859 3.436e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
         Df  Sum Sq Mean Sq F value    Pr(>F)
Location  3 0.83765 0.27921 10.8426 1.753e-05 ***
Family    4 0.87410 0.21852  8.4859 3.436e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
             Estimate Std. Error t value  Pr(>|t|)
(Intercept)   0.42999   0.079313  5.4214 2.236e-06 ***
Location1     0.27409   0.066143  4.1438 0.0001487 ***
Location2     0.07118   0.065245  1.0910 0.2810986
Location3    -0.06869   0.061950 -1.1088 0.2734048
Location4     0.00000   0.000000
Family1       0.18733   0.077778  2.4085 0.0201753 *
Family2      -0.02753   0.079595 -0.3458 0.7310768
Family3       0.31264   0.079951  3.9103 0.0003080 ***
Family4       0.14331   0.093203  1.5376 0.1311397
Family5       0.00000   0.000000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

6.3 Table 13.6

(64) MODEL

```
T13.6 = read.table("C:/G/Rt/ANOVA/T13.6.txt")
colnames(T13.6) = c("Site", "Worker", "Y")
T13.6 = af(T13.6, c("Site", "Worker"))
GLM(Y ~ Site + Worker + Site:Worker, T13.6)
```

```
$ANOVA
Response : Y
                Df  Sum Sq Mean Sq F value     Pr(>F)
MODEL           11 2643.11 240.283  60.323 < 2.2e-16 ***
RESIDUALS       35  139.42   3.983
CORRECTED TOTAL 46 2782.52
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
            Df  Sum Sq Mean Sq F value     Pr(>F)
Site         2 1281.55  640.77 160.866 < 2.2e-16 ***
Worker       3  399.27  133.09  33.412 2.234e-10 ***
Site:Worker  6  962.29  160.38  40.264 2.720e-14 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
            Df  Sum Sq Mean Sq F value     Pr(>F)
Site         2 1322.24  661.12 165.973 < 2.2e-16 ***
Worker       3  399.27  133.09  33.412 2.234e-10 ***
Site:Worker  6  962.29  160.38  40.264 2.720e-14 ***
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
            Df Sum Sq Mean Sq F value     Pr(>F)
Site         2 804.83  402.42 101.026 2.887e-15 ***
Worker       3 430.88  143.63  36.058 8.310e-11 ***
Site:Worker  6 962.29  160.38  40.264 2.720e-14 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
               Estimate Std. Error t value  Pr(>|t|)
(Intercept)      78.560    0.89256 88.0168 < 2.2e-16 ***
Site1             6.340    1.26227  5.0227 1.498e-05 ***
Site2             2.460    1.26227  1.9489  0.059362 .
Site3             0.000    0.00000
Worker1           3.640    1.45754  2.4974  0.017365 *
Worker2           3.840    1.26227  3.0421  0.004433 **
Worker3          15.565    1.33883 11.6258 1.430e-13 ***
Worker4           0.000    0.00000
Site1:Worker1    -5.940    2.62762 -2.2606  0.030108 *
Site1:Worker2     9.720    1.78511  5.4450 4.165e-06 ***
Site1:Worker3    -9.690    1.89340 -5.1178 1.124e-05 ***
Site1:Worker4     0.000    0.00000
Site2:Worker1   -11.960    2.62762 -4.5517 6.165e-05 ***
Site2:Worker2   -12.960    1.84005 -7.0433 3.360e-08 ***
Site2:Worker3   -16.365    1.84005 -8.8938 1.660e-10 ***
Site2:Worker4     0.000    0.00000
Site3:Worker1     0.000    0.00000
Site3:Worker2     0.000    0.00000
Site3:Worker3     0.000    0.00000
Site3:Worker4     0.000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

6.4   Table 14.2

 (65) MODEL

```
T14.2 = read.csv("C:/G/Rt/ANOVA/T14.2.csv")
T14.2 = T14.2[!is.na(T14.2$Y),]
T14.2 = af(T14.2, c("Day", "Machine", "Operator"))
GLM(Y ~ Day + Machine + Operator, T14.2)
```

$ANOVA

```
Response : Y
                 Df  Sum Sq Mean Sq F value     Pr(>F)
MODEL             7  6345.4  906.48  8.1297 5.931e-08 ***
RESIDUALS       110 12265.3  111.50
CORRECTED TOTAL 117 18610.6
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
        Df Sum Sq Mean Sq F value    Pr(>F)
Day      2 3737.8 1868.90 16.7611 4.426e-07 ***
Machine  2 2440.7 1220.33 10.9445 4.625e-05 ***
Operator 3  166.9   55.63  0.4989    0.6838
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
        Df Sum Sq Mean Sq F value    Pr(>F)
Day      2 3795.1 1897.56 17.0181 3.636e-07 ***
Machine  2 2464.8 1232.39 11.0526 4.227e-05 ***
Operator 3  166.9   55.63  0.4989    0.6838
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
        Df Sum Sq Mean Sq F value    Pr(>F)
Day      2 3795.1 1897.56 17.0181 3.636e-07 ***
Machine  2 2464.8 1232.39 11.0526 4.227e-05 ***
Operator 3  166.9   55.63  0.4989    0.6838
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)  194.520     2.8292 68.7541 < 2.2e-16 ***
Day1          -1.395     2.5210 -0.5535    0.5811
Day2         -12.591     2.4293 -5.1831 9.994e-07 ***
Day3           0.000     0.0000
Machine1      10.446     2.4410  4.2795 4.015e-05 ***
Machine2       1.301     2.3888  0.5447    0.5871
Machine3       0.000     0.0000
Operator1     -3.048     2.8546 -1.0677    0.2880
Operator2     -0.076     2.6570 -0.0287    0.9771
Operator3     -0.275     2.7474 -0.0999    0.9206
Operator4      0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

6.5   Table 15.3

(66) MODEL

```
T15.3 = read.table("C:/G/Rt/ANOVA/T15.3.txt")
colnames(T15.3) = c("Dam", "Sire", "pH")
T15.3 = af(T15.3, c("Dam", "Sire"))
GLM(pH ~ Dam/Sire, T15.3) # p301
```

```
$ANOVA
Response : pH
                  Df  Sum Sq   Mean Sq F value  Pr(>F)
MODEL             36 0.25804 0.0071678  2.8977 7.2e-06 ***
RESIDUALS        123 0.30425 0.0024736
CORRECTED TOTAL  159 0.56229
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
         Df    Sum Sq   Mean Sq F value      Pr(>F)
Dam      14 0.178017 0.0127155  5.1405 1.563e-07 ***
Dam:Sire 22 0.080024 0.0036374  1.4705    0.09662 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
         Df    Sum Sq   Mean Sq F value      Pr(>F)
Dam      14 0.178017 0.0127155  5.1405 1.563e-07 ***
Dam:Sire 22 0.080024 0.0036374  1.4705    0.09662 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
         Df    Sum Sq   Mean Sq F value      Pr(>F)
Dam      14 0.179405 0.0128146  5.1805 1.347e-07 ***
Dam:Sire 22 0.080024 0.0036374  1.4705    0.09662 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error  t value   Pr(>|t|)
(Intercept)   7.4125   0.024868 298.0778 < 2.2e-16 ***
Dam1          0.0450   0.035168   1.2796 0.2031065
Dam10         0.0350   0.035168   0.9952 0.3215844
Dam11         0.0755   0.033363   2.2630 0.0253922 *
Dam12         0.0025   0.035168   0.0711 0.9434440
Dam13         0.0400   0.035168   1.1374 0.2575856
```

```
Dam14          0.0555    0.033363    1.6635 0.0987592 .
Dam15          0.0895    0.033363    2.6826 0.0083104 **
Dam2           0.0225    0.035168    0.6398 0.5235039
Dam3           0.0295    0.033363    0.8842 0.3783132
Dam4          -0.0275    0.035168   -0.7820 0.4357428
Dam5           0.1408    0.037986    3.7075 0.0003152 ***
Dam6           0.0475    0.033363    1.4237 0.1570616
Dam7           0.0315    0.033363    0.9441 0.3469459
Dam8           0.0455    0.033363    1.3638 0.1751317
Dam9           0.0000    0.000000
Dam1:Sire1     0.0475    0.035168    1.3507 0.1792866
Dam1:Sire2     0.0000    0.000000
Dam1:Sire3     0.0000    0.000000
Dam10:Sire1   -0.0695    0.033363   -2.0831 0.0393121 *
Dam10:Sire2    0.0000    0.000000
Dam10:Sire3    0.0000    0.000000
Dam11:Sire1    0.0460    0.031455    1.4624 0.1461852
Dam11:Sire2    0.0000    0.000000
Dam11:Sire3    0.0000    0.000000
Dam12:Sire1    0.0470    0.033363    1.4087 0.1614391
Dam12:Sire2    0.0000    0.000000
Dam12:Sire3    0.0000    0.000000
Dam13:Sire1   -0.0645    0.033363   -1.9333 0.0555032 .
Dam13:Sire2   -0.0358    0.037986   -0.9433 0.3473613
Dam13:Sire3    0.0000    0.000000
Dam14:Sire1    0.0245    0.033363    0.7343 0.4641417
Dam14:Sire2   -0.0180    0.033363   -0.5395 0.5905089
Dam14:Sire3    0.0000    0.000000
Dam15:Sire1   -0.0500    0.031455   -1.5896 0.1145028
Dam15:Sire2   -0.0580    0.031455   -1.8439 0.0676071 .
Dam15:Sire3    0.0000    0.000000
Dam2:Sire1    -0.0010    0.033363   -0.0300 0.9761373
Dam2:Sire2     0.0000    0.000000
Dam2:Sire3     0.0000    0.000000
Dam3:Sire1    -0.0045    0.033363   -0.1349 0.8929288
Dam3:Sire2    -0.0320    0.033363   -0.9591 0.3393736
Dam3:Sire3     0.0000    0.000000
Dam4:Sire1     0.0550    0.037986    1.4479 0.1501886
Dam4:Sire2     0.0000    0.000000
Dam4:Sire3     0.0000    0.000000
Dam5:Sire1    -0.0593    0.036322   -1.6336 0.1049091
Dam5:Sire2    -0.0608    0.037986   -1.6015 0.1118387
Dam5:Sire3     0.0000    0.000000
Dam6:Sire1    -0.0450    0.033363   -1.3488 0.1798857
Dam6:Sire2     0.0075    0.033363    0.2248 0.8225105
Dam6:Sire3     0.0000    0.000000
Dam7:Sire1    -0.0290    0.033363   -0.8692 0.3864232
Dam7:Sire2    -0.0340    0.031455   -1.0809 0.2818582
```

```
Dam7:Sire3     0.0000    0.000000
Dam8:Sire1     0.0520    0.036322    1.4317 0.1547783
Dam8:Sire2     0.0000    0.000000
Dam8:Sire3     0.0000    0.000000
Dam9:Sire1    -0.0225    0.035168   -0.6398 0.5235039
Dam9:Sire2     0.0000    0.000000
Dam9:Sire3     0.0000    0.000000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
options(contrasts = c("contr.sum", "contr.poly"))
Anova(lm(pH ~ Dam/Sire, T15.3), type=3, singular.ok=TRUE) # NOT OK
```

```
Note: model has aliased coefficients
      sums of squares computed by model comparison


Anova Table (Type III tests)

Response: pH
            Sum Sq  Df F values     Pr(>F)
Dam        0.081011   6   5.4584 4.898e-05 ***
Dam:Sire   0.080024  22   1.4705   0.09662 .
Residuals  0.304253 123
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

6.6   Table 16.3

(67) MODEL

```
T16.3 = read.csv("C:/G/Rt/ANOVA/T16.3.csv")
colnames(T16.3) = c("Plot", "Sample", "Subsample", "Residue")
T16.3 = af(T16.3, c("Plot", "Sample", "Subsample"))
GLM(Residue ~ Plot/Sample/Subsample, T16.3) # p344
```

```
$ANOVA
Response : Residue
                Df Sum Sq  Mean Sq F value     Pr(>F)
MODEL           54 3.1897 0.059069  5.8842 1.476e-05 ***
RESIDUALS       22 0.2208 0.010039
CORRECTED TOTAL 76 3.4106
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
```

```
                      Df  Sum Sq  Mean Sq F value    Pr(>F)
Plot                  10 1.84041 0.184041 18.3332 1.929e-08 ***
Plot:Sample           22 0.99175 0.045079  4.4906 0.0004209 ***
Plot:Sample:Subsample 22 0.35757 0.016253  1.6191 0.1330632
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
                      Df  Sum Sq  Mean Sq F value    Pr(>F)
Plot                  10 1.84041 0.184041 18.3332 1.929e-08 ***
Plot:Sample           22 0.99175 0.045079  4.4906 0.0004209 ***
Plot:Sample:Subsample 22 0.35757 0.016253  1.6191 0.1330632
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
                      Df  Sum Sq  Mean Sq F value    Pr(>F)
Plot                  10 1.78686 0.178686 17.7998 2.547e-08 ***
Plot:Sample           22 0.99175 0.045079  4.4906 0.0004209 ***
Plot:Sample:Subsample 22 0.35757 0.016253  1.6191 0.1330632
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
                 Estimate Std. Error t value  Pr(>|t|)
(Intercept)         0.920    0.10019  9.1823 5.568e-09 ***
Plot1              -0.400    0.14169 -2.8230 0.0099043 **
Plot10             -0.400    0.14169 -2.8230 0.0099043 **
Plot11             -0.530    0.14169 -3.7404 0.0011335 **
Plot2               0.160    0.14169  1.1292 0.2709797
Plot3              -0.630    0.14169 -4.4462 0.0002029 ***
Plot4              -0.820    0.14169 -5.7871 8.025e-06 ***
Plot5               0.000    0.14169  0.0000 1.0000000
Plot6              -0.510    0.14169 -3.5993 0.0015942 **
Plot7              -0.480    0.14169 -3.3876 0.0026487 **
Plot8              -0.560    0.14169 -3.9522 0.0006777 ***
Plot9               0.000    0.00000
Plot1:Sample1      -0.060    0.12271 -0.4890 0.6297131
Plot1:Sample2       0.020    0.14169  0.1411 0.8890368
Plot1:Sample3       0.000    0.00000
Plot10:Sample1     -0.020    0.12271 -0.1630 0.8720183
Plot10:Sample2      0.000    0.14169  0.0000 1.0000000
Plot10:Sample3      0.000    0.00000
Plot11:Sample1      0.000    0.12271  0.0000 1.0000000
Plot11:Sample2      0.110    0.14169  0.7763 0.4458271
Plot11:Sample3      0.000    0.00000
Plot2:Sample1      -0.595    0.12271 -4.8488 7.603e-05 ***
Plot2:Sample2      -0.650    0.14169 -4.5873 0.0001437 ***
```

```
Plot2:Sample3                  0.000    0.00000
Plot3:Sample1                  0.095    0.12271   0.7742 0.4470663
Plot3:Sample2                  0.090    0.14169   0.6352 0.5318688
Plot3:Sample3                  0.000    0.00000
Plot4:Sample1                  0.200    0.12271   1.6298 0.1173694
Plot4:Sample2                  0.150    0.14169   1.0586 0.3012597
Plot4:Sample3                  0.000    0.00000
Plot5:Sample1                 -0.365    0.12271  -2.9745 0.0069960 **
Plot5:Sample2                 -0.080    0.14169  -0.5646 0.5780606
Plot5:Sample3                  0.000    0.00000
Plot6:Sample1                  0.065    0.12271   0.5297 0.6016249
Plot6:Sample2                 -0.150    0.14169  -1.0586 0.3012597
Plot6:Sample3                  0.000    0.00000
Plot7:Sample1                  0.115    0.12271   0.9372 0.3588500
Plot7:Sample2                  0.060    0.14169   0.4234 0.6760804
Plot7:Sample3                  0.000    0.00000
Plot8:Sample1                  0.305    0.12271   2.4855 0.0210209 *
Plot8:Sample2                  0.180    0.14169   1.2703 0.2172344
Plot8:Sample3                  0.000    0.00000
Plot9:Sample1                 -0.355    0.12271  -2.8930 0.0084403 **
Plot9:Sample2                 -0.210    0.14169  -1.4821 0.1525064
Plot9:Sample3                  0.000    0.00000
Plot1:Sample1:Subsample1       0.015    0.10019   0.1497 0.8823566
Plot1:Sample1:Subsample2       0.000    0.00000
Plot1:Sample2:Subsample1      -0.280    0.14169  -1.9761 0.0608176 .
Plot1:Sample2:Subsample2       0.000    0.00000
Plot1:Sample3:Subsample1       0.000    0.00000
Plot1:Sample3:Subsample2       0.000    0.00000
Plot10:Sample1:Subsample1      0.050    0.10019   0.4990 0.6227069
Plot10:Sample1:Subsample2      0.000    0.00000
Plot10:Sample2:Subsample1     -0.060    0.14169  -0.4234 0.6760804
Plot10:Sample2:Subsample2      0.000    0.00000
Plot10:Sample3:Subsample1      0.000    0.00000
Plot10:Sample3:Subsample2      0.000    0.00000
Plot11:Sample1:Subsample1     -0.090    0.10019  -0.8983 0.3787697
Plot11:Sample1:Subsample2      0.000    0.00000
Plot11:Sample2:Subsample1      0.030    0.14169   0.2117 0.8342720
Plot11:Sample2:Subsample2      0.000    0.00000
Plot11:Sample3:Subsample1      0.000    0.00000
Plot11:Sample3:Subsample2      0.000    0.00000
Plot2:Sample1:Subsample1       0.060    0.10019   0.5988 0.5553935
Plot2:Sample1:Subsample2       0.000    0.00000
Plot2:Sample2:Subsample1      -0.390    0.14169  -2.7524 0.0116232 *
Plot2:Sample2:Subsample2       0.000    0.00000
Plot2:Sample3:Subsample1       0.000    0.00000
Plot2:Sample3:Subsample2       0.000    0.00000
Plot3:Sample1:Subsample1      -0.085    0.10019  -0.8484 0.4053723
Plot3:Sample1:Subsample2       0.000    0.00000
```

```
Plot3:Sample2:Subsample1      -0.130      0.14169 -0.9175 0.3688465
Plot3:Sample2:Subsample2       0.000      0.00000
Plot3:Sample3:Subsample1       0.000      0.00000
Plot3:Sample3:Subsample2       0.000      0.00000
Plot4:Sample1:Subsample1      -0.090      0.10019 -0.8983 0.3787697
Plot4:Sample1:Subsample2       0.000      0.00000
Plot4:Sample2:Subsample1      -0.120      0.14169 -0.8469 0.4061732
Plot4:Sample2:Subsample2       0.000      0.00000
Plot4:Sample3:Subsample1       0.000      0.00000
Plot4:Sample3:Subsample2       0.000      0.00000
Plot5:Sample1:Subsample1       0.300      0.10019  2.9942 0.0066835 **
Plot5:Sample1:Subsample2       0.000      0.00000
Plot5:Sample2:Subsample1       0.110      0.14169  0.7763 0.4458271
Plot5:Sample2:Subsample2       0.000      0.00000
Plot5:Sample3:Subsample1       0.000      0.00000
Plot5:Sample3:Subsample2       0.000      0.00000
Plot6:Sample1:Subsample1       0.115      0.10019  1.1478 0.2633860
Plot6:Sample1:Subsample2       0.000      0.00000
Plot6:Sample2:Subsample1       0.070      0.14169  0.4940 0.6261876
Plot6:Sample2:Subsample2       0.000      0.00000
Plot6:Sample3:Subsample1       0.000      0.00000
Plot6:Sample3:Subsample2       0.000      0.00000
Plot7:Sample1:Subsample1       0.110      0.10019  1.0979 0.2841276
Plot7:Sample1:Subsample2       0.000      0.00000
Plot7:Sample2:Subsample1      -0.060      0.14169 -0.4234 0.6760804
Plot7:Sample2:Subsample2       0.000      0.00000
Plot7:Sample3:Subsample1       0.000      0.00000
Plot7:Sample3:Subsample2       0.000      0.00000
Plot8:Sample1:Subsample1       0.240      0.10019  2.3954 0.0255487 *
Plot8:Sample1:Subsample2       0.000      0.00000
Plot8:Sample2:Subsample1       0.100      0.14169  0.7057 0.4877535
Plot8:Sample2:Subsample2       0.000      0.00000
Plot8:Sample3:Subsample1       0.000      0.00000
Plot8:Sample3:Subsample2       0.000      0.00000
Plot9:Sample1:Subsample1       0.020      0.10019  0.1996 0.8436154
Plot9:Sample1:Subsample2       0.000      0.00000
Plot9:Sample2:Subsample1      -0.110      0.14169 -0.7763 0.4458271
Plot9:Sample2:Subsample2       0.000      0.00000
Plot9:Sample3:Subsample1       0.000      0.00000
Plot9:Sample3:Subsample2       0.000      0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
options(contrasts = c("contr.sum", "contr.poly"))
Anova(lm(Residue ~ Plot/Sample/Subsample, T16.3), type=3, singular.ok=TRUE)
```

```
Note: model has aliased coefficients
```

```
      sums of squares computed by model comparison


Anova Table (Type III tests)

Response: Residue
                       Sum Sq Df F values  Pr(>F)
Plot                  0.00000  0
Plot:Sample           0.36613 11   3.3156 0.00805 **
Plot:Sample:Subsample 0.35758 22   1.6191 0.13306
Residuals             0.22085 22
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# NOT OK
```

7 Federer - Variations

Reference

- Federer WT, King F. Variations on Split Plot and Split Block Experiment Designs. John Wiley & Sons Inc. 2007.

7.1 Example 1.1

(68) MODEL

```
ex1.1 = read.table("C:/G/Rt/Split/Ex1.1-spex1.txt", header=TRUE)
ex1.1 = af(ex1.1, c("R", "A", "B"))
GLM(Y ~ R + A + R:A + B + A:B, ex1.1)
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value     Pr(>F)
MODEL           27 4905.7 181.694   10.75 1.994e-10 ***
RESIDUALS       36  608.5  16.902
CORRECTED TOTAL 63 5514.2
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
    Df Sum Sq Mean Sq F value     Pr(>F)
R    3  223.8   74.60  4.4138    0.00963 **
A    3  194.6   64.85  3.8370    0.01756 *
R:A  9  158.2   17.58  1.0402    0.42842
B    3 4107.4 1369.13 81.0030 4.441e-16 ***
A:B  9  221.7   24.64  1.4577    0.20117
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
    Df Sum Sq Mean Sq F value     Pr(>F)
R    3  223.8   74.60  4.4138    0.00963 **
A    3  194.6   64.85  3.8370    0.01756 *
R:A  9  158.2   17.58  1.0402    0.42842
B    3 4107.4 1369.13 81.0030 4.441e-16 ***
A:B  9  221.7   24.64  1.4577    0.20117
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
    Df Sum Sq Mean Sq F value     Pr(>F)
```

```
R     3  223.8    74.60   4.4138    0.00963 **
A     3  194.6    64.85   3.8370    0.01756 *
R:A   9  158.2    17.58   1.0402    0.42842
B     3 4107.4 1369.13  81.0030 4.441e-16 ***
A:B   9  221.7    24.64   1.4577    0.20117
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
             Estimate Std. Error t value   Pr(>|t|)
(Intercept)    66.700     2.7193 24.5282 < 2.2e-16 ***
R1              6.750     2.9071  2.3219  0.026009 *
R2             10.025     2.9071  3.4485  0.001453 **
R3              5.825     2.9071  2.0037  0.052669 .
R4              0.000     0.0000
A1              6.856     3.8457  1.7828  0.083048 .
A2             -4.212     3.8457 -1.0954  0.280625
A3              2.231     3.8457  0.5802  0.565398
A4              0.000     0.0000
R1:A1          -4.050     4.1112 -0.9851  0.331146
R1:A2          -3.375     4.1112 -0.8209  0.417093
R1:A3          -3.800     4.1112 -0.9243  0.361485
R1:A4           0.000     0.0000
R2:A1         -11.325     4.1112 -2.7547  0.009156 **
R2:A2          -5.150     4.1112 -1.2527  0.218403
R2:A3          -6.475     4.1112 -1.5750  0.124015
R2:A4           0.000     0.0000
R3:A1          -7.550     4.1112 -1.8364  0.074562 .
R3:A2          -5.625     4.1112 -1.3682  0.179727
R3:A3          -6.650     4.1112 -1.6175  0.114496
R3:A4           0.000     0.0000
R4:A1           0.000     0.0000
R4:A2           0.000     0.0000
R4:A3           0.000     0.0000
R4:A4           0.000     0.0000
B1             -1.800     2.9071 -0.6192  0.539698
B2            -17.100     2.9071 -5.8822 9.985e-07 ***
B3             -1.000     2.9071 -0.3440  0.732856
B4              0.000     0.0000
A1:B1           3.700     4.1112  0.9000  0.374115
A1:B2          -4.275     4.1112 -1.0398  0.305350
A1:B3          -0.250     4.1112 -0.0608  0.951848
A1:B4           0.000     0.0000
A2:B1           9.500     4.1112  2.3107  0.026687 *
A2:B2           3.850     4.1112  0.9365  0.355276
A2:B3           4.400     4.1112  1.0702  0.291635
A2:B4           0.000     0.0000
A3:B1          -1.225     4.1112 -0.2980  0.767443
```

```
A3:B2          -2.800      4.1112 -0.6811  0.500190
A3:B3           1.900      4.1112  0.4621  0.646755
A3:B4           0.000      0.0000
A4:B1           0.000      0.0000
A4:B2           0.000      0.0000
A4:B3           0.000      0.0000
A4:B4           0.000      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.2   Example 1.2

(69) MODEL

```
ex1.2 = read.table("C:/G/Rt/Split/Ex1.2-spex2.txt", header=TRUE)
ex1.2 = af(ex1.2, c("R", "A", "B"))
GLM(Y ~ R + A + R:A + B + A:B, ex1.2)
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           47  35573  756.88  31.243 < 2.2e-16 ***
RESIDUALS       48   1163   24.23
CORRECTED TOTAL 95  36736
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
    Df  Sum Sq Mean Sq  F value     Pr(>F)
R    2    38.6    19.3   0.7963 0.4568480
A    7   763.2   109.0   4.5003 0.0006418 ***
R:A 14  1377.2    98.4   4.0608 0.0001343 ***
B    3 30774.3 10258.1 423.4386 < 2.2e-16 ***
A:B 21  2620.1   124.8   5.1502 1.327e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
    Df  Sum Sq Mean Sq  F value     Pr(>F)
R    2    38.6    19.3   0.7963 0.4568480
A    7   763.2   109.0   4.5003 0.0006418 ***
R:A 14  1377.2    98.4   4.0608 0.0001343 ***
B    3 30774.3 10258.1 423.4386 < 2.2e-16 ***
A:B 21  2620.1   124.8   5.1502 1.327e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
    Df  Sum Sq Mean Sq  F value      Pr(>F)
R    2    38.6    19.3   0.7963 0.4568480
A    7   763.2   109.0   4.5003 0.0006418 ***
R:A 14  1377.2    98.4   4.0608 0.0001343 ***
B    3 30774.3 10258.1 423.4386 < 2.2e-16 ***
A:B 21  2620.1   124.8   5.1502 1.327e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   16.000     3.4804  4.5972 3.130e-05 ***
R1            -6.250     3.4804 -1.7958 0.0788230 .
R2            -5.750     3.4804 -1.6521 0.1050354
R3             0.000     0.0000
A0            -7.083     4.9220 -1.4391 0.1566037
A1            -4.000     4.9220 -0.8127 0.4204117
A2            -4.500     4.9220 -0.9143 0.3651450
A3            -6.333     4.9220 -1.2868 0.2043526
A4            -3.500     4.9220 -0.7111 0.4804644
A5            -1.667     4.9220 -0.3386 0.7363740
A6            -6.250     4.9220 -1.2698 0.2102707
A7             0.000     0.0000
R1:A0          5.250     4.9220  1.0666 0.2914665
R1:A1         15.000     4.9220  3.0476 0.0037444 **
R1:A2         -0.500     4.9220 -0.1016 0.9195088
R1:A3          7.250     4.9220  1.4730 0.1472813
R1:A4          5.000     4.9220  1.0159 0.3147916
R1:A5          8.000     4.9220  1.6254 0.1106329
R1:A6         10.500     4.9220  2.1333 0.0380399 *
R1:A7          0.000     0.0000
R2:A0          5.000     4.9220  1.0159 0.3147916
R2:A1         -5.000     4.9220 -1.0159 0.3147916
R2:A2         12.000     4.9220  2.4381 0.0185190 *
R2:A3          4.750     4.9220  0.9651 0.3393506
R2:A4          4.500     4.9220  0.9143 0.3651450
R2:A5         12.000     4.9220  2.4381 0.0185190 *
R2:A6          2.250     4.9220  0.4571 0.6496363
R2:A7          0.000     0.0000
R3:A0          0.000     0.0000
R3:A1          0.000     0.0000
R3:A2          0.000     0.0000
R3:A3          0.000     0.0000
R3:A4          0.000     0.0000
R3:A5          0.000     0.0000
R3:A6          0.000     0.0000
```

```
R3:A7          0.000      0.0000
B0            36.000      4.0188   8.9580 8.177e-12 ***
B1             7.667      4.0188   1.9077 0.0624200 .
B2            19.333      4.0188   4.8108 1.531e-05 ***
B3             0.000      0.0000
A0:B0         22.000      5.6834   3.8709 0.0003271 ***
A0:B1         -4.333      5.6834  -0.7625 0.4495188
A0:B2        -15.333      5.6834  -2.6979 0.0096001 **
A0:B3          0.000      0.0000
A1:B0         16.000      5.6834   2.8152 0.0070497 **
A1:B1         -0.667      5.6834  -0.1173 0.9071111
A1:B2        -16.333      5.6834  -2.8739 0.0060246 **
A1:B3          0.000      0.0000
A2:B0         17.667      5.6834   3.1085 0.0031582 **
A2:B1         -6.333      5.6834  -1.1144 0.2706743
A2:B2         -4.333      5.6834  -0.7625 0.4495188
A2:B3          0.000      0.0000
A3:B0          4.667      5.6834   0.8211 0.4156454
A3:B1         -7.333      5.6834  -1.2903 0.2031245
A3:B2        -15.000      5.6834  -2.6393 0.0111717 *
A3:B3          0.000      0.0000
A4:B0          1.667      5.6834   0.2933 0.7705935
A4:B1         -3.000      5.6834  -0.5279 0.6000325
A4:B2        -20.667      5.6834  -3.6363 0.0006736 ***
A4:B3          0.000      0.0000
A5:B0          5.000      5.6834   0.8798 0.3833746
A5:B1        -16.667      5.6834  -2.9325 0.0051395 **
A5:B2         -6.667      5.6834  -1.1730 0.2465806
A5:B3          0.000      0.0000
A6:B0          0.333      5.6834   0.0587 0.9534740
A6:B1         -3.000      5.6834  -0.5279 0.6000325
A6:B2         -7.333      5.6834  -1.2903 0.2031245
A6:B3          0.000      0.0000
A7:B0          0.000      0.0000
A7:B1          0.000      0.0000
A7:B2          0.000      0.0000
A7:B3          0.000      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.3 Example 2.1

(70) MODEL

```
ex2.1 = read.table("C:/G/Rt/Split/sbex.txt", header=TRUE)
colnames(ex2.1) = c("Y", "R", "A", "B")
```

```
ex2.1 = af(ex2.1, c("R", "A", "B"))
GLM(Y ~ R + A + R:A + B + R:B + A:B, ex2.1)
```

$ANOVA
Response : Y
```
                 Df  Sum Sq Mean Sq F value    Pr(>F)
MODEL            41 274.750  6.7012  5.1475 0.0002305 ***
RESIDUALS        18  23.433  1.3019
CORRECTED TOTAL  59 298.183
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

$`Type I`
```
    Df Sum Sq Mean Sq F value     Pr(>F)
R    1  2.817  2.8167  2.1636 0.1585807
A    9 77.683  8.6315  6.6302 0.0003456 ***
R:A  9 81.017  9.0019  6.9147 0.0002658 ***
B    2 35.433 17.7167 13.6088 0.0002510 ***
R:B  2 16.233  8.1167  6.2347 0.0087635 **
A:B 18 61.567  3.4204  2.6273 0.0236253 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

$`Type II`
```
    Df Sum Sq Mean Sq F value     Pr(>F)
R    1  2.817  2.8167  2.1636 0.1585807
A    9 77.683  8.6315  6.6302 0.0003456 ***
R:A  9 81.017  9.0019  6.9147 0.0002658 ***
B    2 35.433 17.7167 13.6088 0.0002510 ***
R:B  2 16.233  8.1167  6.2347 0.0087635 **
A:B 18 61.567  3.4204  2.6273 0.0236253 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

$`Type III`
```
    Df Sum Sq Mean Sq F value     Pr(>F)
R    1  2.817  2.8167  2.1636 0.1585807
A    9 77.683  8.6315  6.6302 0.0003456 ***
R:A  9 81.017  9.0019  6.9147 0.0002658 ***
B    2 35.433 17.7167 13.6088 0.0002510 ***
R:B  2 16.233  8.1167  6.2347 0.0087635 **
A:B 18 61.567  3.4204  2.6273 0.0236253 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

$Parameter
```
           Estimate Std. Error t value  Pr(>|t|)
```

```
(Intercept)    46.583    0.95462 48.7979 < 2.2e-16 ***
R1              0.833    1.02053  0.8166  0.424850
R2              0.000    0.00000
A0             -3.833    1.31750 -2.9096  0.009350 **
A1              2.667    1.31750  2.0240  0.058068 .
A2              1.000    1.31750  0.7590  0.457669
A3             -2.167    1.31750 -1.6445  0.117418
A4              1.000    1.31750  0.7590  0.457669
A5             -1.333    1.31750 -1.0120  0.324940
A6              1.500    1.31750  1.1385  0.269830
A7              4.500    1.31750  3.4156  0.003083 **
A8             -0.167    1.31750 -0.1265  0.900737
A9              0.000    0.00000
R1:A0           1.667    1.31750  1.2650  0.221996
R1:A1          -3.333    1.31750 -2.5300  0.020955 *
R1:A2          -4.000    1.31750 -3.0361  0.007105 **
R1:A3           0.333    1.31750  0.2530  0.803131
R1:A4           0.000    1.31750  0.0000  1.000000
R1:A5           2.667    1.31750  2.0240  0.058068 .
R1:A6          -4.000    1.31750 -3.0361  0.007105 **
R1:A7          -3.000    1.31750 -2.2770  0.035225 *
R1:A8          -2.667    1.31750 -2.0240  0.058068 .
R1:A9           0.000    0.00000
R2:A0           0.000    0.00000
R2:A1           0.000    0.00000
R2:A2           0.000    0.00000
R2:A3           0.000    0.00000
R2:A4           0.000    0.00000
R2:A5           0.000    0.00000
R2:A6           0.000    0.00000
R2:A7           0.000    0.00000
R2:A8           0.000    0.00000
R2:A9           0.000    0.00000
B1             -3.150    1.19668 -2.6323  0.016910 *
B2             -0.600    1.19668 -0.5014  0.622175
B3              0.000    0.00000
R1:B1           2.300    0.72162  3.1873  0.005103 **
R1:B2           0.200    0.72162  0.2772  0.784821
R1:B3           0.000    0.00000
R2:B1           0.000    0.00000
R2:B2           0.000    0.00000
R2:B3           0.000    0.00000
A0:B1           3.000    1.61360  1.8592  0.079426 .
A0:B2           0.500    1.61360  0.3099  0.760221
A0:B3           0.000    0.00000
A1:B1          -3.000    1.61360 -1.8592  0.079426 .
A1:B2          -4.000    1.61360 -2.4789  0.023305 *
A1:B3           0.000    0.00000
```

```
A2:B1           2.500    1.61360  1.5493  0.138705
A2:B2          -2.500    1.61360 -1.5493  0.138705
A2:B3           0.000    0.00000
A3:B1           2.000    1.61360  1.2395  0.231091
A3:B2          -0.500    1.61360 -0.3099  0.760221
A3:B3           0.000    0.00000
A4:B1          -2.000    1.61360 -1.2395  0.231091
A4:B2          -1.000    1.61360 -0.6197  0.543200
A4:B3           0.000    0.00000
A5:B1           1.000    1.61360  0.6197  0.543200
A5:B2           0.000    1.61360  0.0000  1.000000
A5:B3           0.000    0.00000
A6:B1          -1.000    1.61360 -0.6197  0.543200
A6:B2          -0.500    1.61360 -0.3099  0.760221
A6:B3           0.000    0.00000
A7:B1          -0.500    1.61360 -0.3099  0.760221
A7:B2          -2.000    1.61360 -1.2395  0.231091
A7:B3           0.000    0.00000
A8:B1           2.500    1.61360  1.5493  0.138705
A8:B2          -2.000    1.61360 -1.2395  0.231091
A8:B3           0.000    0.00000
A9:B1           0.000    0.00000
A9:B2           0.000    0.00000
A9:B3           0.000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.4 Example 2.2

(71) MODEL

```r
ex2.2 = read.table("C:/G/Rt/Split/sbex2_2.txt", header=TRUE)
ex2.2 = af(ex2.2, c("Row", "Column", "R", "S"))
GLM(Y ~ Column + R + R:Column + S + S:Column + R:S, ex2.2)
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL           51  10328  202.51  0.8112 0.7688
RESIDUALS       48  11982  249.63
CORRECTED TOTAL 99  22310

$`Type I`
        Df Sum Sq Mean Sq F value Pr(>F)
Column   4 1318.6  329.66  1.3206 0.2758
R        4 1159.8  289.94  1.1615 0.3396
```

```
Column:R 16 2808.6   175.54   0.7032 0.7766
S          3  351.9   117.29   0.4699 0.7047
Column:S 12 3863.3   321.94   1.2897 0.2555
R:S       12  826.0    68.83   0.2757 0.9906


$`Type II`
        Df Sum Sq Mean Sq F value Pr(>F)
Column   4 1318.6  329.66  1.3206 0.2758
R        4 1159.8  289.94  1.1615 0.3396
Column:R 16 2808.6  175.54  0.7032 0.7766
S        3  351.9  117.29  0.4699 0.7047
Column:S 12 3863.3  321.94  1.2897 0.2555
R:S      12  826.0   68.83  0.2757 0.9906


$`Type III`
        Df Sum Sq Mean Sq F value Pr(>F)
Column   4 1318.6  329.66  1.3206 0.2758
R        4 1159.8  289.94  1.1615 0.3396
Column:R 16 2808.6  175.54  0.7032 0.7766
S        3  351.9  117.29  0.4699 0.7047
Column:S 12 3863.3  321.94  1.2897 0.2555
R:S      12  826.0   68.83  0.2757 0.9906


$Parameter
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  1000.52     11.393 87.8167  < 2e-16 ***
Column1        12.04     14.132  0.8522  0.39836
Column2        10.64     14.132  0.7529  0.45520
Column3         0.98     14.132  0.0696  0.94478
Column4       -12.93     14.132 -0.9149  0.36480
Column5         0.00      0.000
R1            -13.81     14.132 -0.9774  0.33325
R2            -10.85     14.132 -0.7678  0.44636
R3             -2.17     14.132 -0.1533  0.87880
R4             -3.63     14.132 -0.2571  0.79819
R5              0.00      0.000
Column1:R1     16.78     15.800  1.0619  0.29360
Column1:R2      5.34     15.800  0.3383  0.73661
Column1:R3     -9.13     15.800 -0.5775  0.56627
Column1:R4     -6.31     15.800 -0.3994  0.69139
Column1:R5      0.00      0.000
Column2:R1     16.71     15.800  1.0578  0.29545
Column2:R2     -1.64     15.800 -0.1036  0.91789
Column2:R3      7.40     15.800  0.4687  0.64142
Column2:R4     11.71     15.800  0.7413  0.46212
Column2:R5      0.00      0.000
Column3:R1     12.12     15.800  0.7671  0.44678
Column3:R2      0.27     15.800  0.0169  0.98656
```

```
Column3:R3     -14.04      15.800 -0.8885   0.37872
Column3:R4       9.01      15.800  0.5703   0.57116
Column3:R5       0.00       0.000
Column4:R1       1.31      15.800  0.0832   0.93402
Column4:R2      -3.85      15.800 -0.2438   0.80840
Column4:R3       0.84      15.800  0.0532   0.95782
Column4:R4       9.65      15.800  0.6111   0.54402
Column4:R5       0.00       0.000
Column5:R1       0.00       0.000
Column5:R2       0.00       0.000
Column5:R3       0.00       0.000
Column5:R4       0.00       0.000
Column5:R5       0.00       0.000
S1               3.74      13.406  0.2789   0.78154
S2              12.15      13.406  0.9066   0.36916
S3               2.83      13.406  0.2110   0.83380
S4               0.00       0.000
Column1:S1     -15.16      14.132 -1.0730   0.28861
Column1:S2     -31.48      14.132 -2.2278   0.03062 *
Column1:S3       1.26      14.132  0.0889   0.92955
Column1:S4       0.00       0.000
Column2:S1     -22.54      14.132 -1.5947   0.11734
Column2:S2     -31.01      14.132 -2.1946   0.03306 *
Column2:S3      -3.56      14.132 -0.2518   0.80229
Column2:S4       0.00       0.000
Column3:S1      -1.71      14.132 -0.1207   0.90442
Column3:S2     -14.46      14.132 -1.0229   0.31146
Column3:S3      19.65      14.132  1.3902   0.17088
Column3:S4       0.00       0.000
Column4:S1       5.39      14.132  0.3816   0.70448
Column4:S2      -3.36      14.132 -0.2376   0.81319
Column4:S3      17.58      14.132  1.2443   0.21943
Column4:S4       0.00       0.000
Column5:S1       0.00       0.000
Column5:S2       0.00       0.000
Column5:S3       0.00       0.000
Column5:S4       0.00       0.000
R1:S1            3.84      14.132  0.2714   0.78721
R1:S2           -1.62      14.132 -0.1148   0.90910
R1:S3          -11.37      14.132 -0.8047   0.42495
R1:S4            0.00       0.000
R2:S1           12.02      14.132  0.8507   0.39915
R2:S2           10.32      14.132  0.7300   0.46894
R2:S3           -6.46      14.132 -0.4568   0.64984
R2:S4            0.00       0.000
R3:S1            9.62      14.132  0.6810   0.49913
R3:S2            2.19      14.132  0.1551   0.87738
R3:S3           -8.14      14.132 -0.5760   0.56730
```

```
R3:S4            0.00      0.000
R4:S1            4.15     14.132  0.2939  0.77006
R4:S2            3.09     14.132  0.2189  0.82762
R4:S3           -6.44     14.132 -0.4560  0.65045
R4:S4            0.00      0.000
R5:S1            0.00      0.000
R5:S2            0.00      0.000
R5:S3            0.00      0.000
R5:S4            0.00      0.000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

 (72) MODEL

```
GLM(Y ~ Row + R + Row:R + S + Column:S + R:S + Column:R:S, ex2.2)
```

```
$ANOVA
Response : Y
               Df Sum Sq Mean Sq F value Pr(>F)
MODEL          99  22310  225.36
RESIDUALS       0      0
CORRECTED TOTAL 99  22310

$`Type I`
           Df  Sum Sq Mean Sq F value Pr(>F)
Row         4   147.4   36.86
R           4  1159.8  289.94
Row:R      16  3979.8  248.74
S           3   351.9  117.29
S:Column   12  3863.3  321.94
R:S        12   826.0   68.83
R:S:Column 48 11982.3  249.63

$`Type II`
           Df  Sum Sq Mean Sq F value Pr(>F)
Row         0
R           4  1159.8  289.94
Row:R       0
S           3   351.9  117.29
S:Column   12  3863.3  321.94
R:S        12   826.0   68.83
R:S:Column 48 11982.3  249.63

$`Type III`
CAUTION: Singularity Exists !
           Df  Sum Sq Mean Sq F value Pr(>F)
Row         0
```

```
R            4  1159.8  289.94
Row:R        0
S            3   351.9  117.29
S:Column    12  3863.3  321.94
R:S         12   826.0   68.83
R:S:Column  48 11982.3  249.63


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  1001.61
Row1           -5.98
Row2           16.88
Row3           19.34
Row4          -24.93
Row5            0.00
R1              9.12
R2            -18.93
R3             -2.75
R4              3.02
R5              0.00
Row1:R1         3.72
Row1:R2        14.16
Row1:R3       -24.63
Row1:R4         3.52
Row1:R5         0.00
Row2:R1       -61.81
Row2:R2        12.43
Row2:R3        -0.94
Row2:R4       -20.79
Row2:R5         0.00
Row3:R1       -56.60
Row3:R2       -12.11
Row3:R3       -30.06
Row3:R4        -4.44
Row3:R5         0.00
Row4:R1        46.95
Row4:R2        26.04
Row4:R3        43.63
Row4:R4        12.51
Row4:R5         0.00
Row5:R1         0.00
Row5:R2         0.00
Row5:R3         0.00
Row5:R4         0.00
Row5:R5         0.00
S1             24.26
S2             21.85
S3             -7.81
```

```
S4                 0.00
S1:Column1       -47.84
S1:Column2       -58.48
S1:Column3       -40.38
S1:Column4        10.08
S1:Column5         0.00
S2:Column1       -40.43
S2:Column2       -13.68
S2:Column3       -58.94
S2:Column4       -15.74
S2:Column5         0.00
S3:Column1        -0.39
S3:Column2        33.69
S3:Column3         5.46
S3:Column4        49.36
S3:Column5         0.00
S4:Column1         0.00
S4:Column2         0.00
S4:Column3         0.00
S4:Column4         0.00
S4:Column5         0.00
R1:S1            -12.01
R1:S2             17.28
R1:S3             18.96
R1:S4              0.00
R2:S1            -39.64
R2:S2            -21.90
R2:S3            -31.42
R2:S4              0.00
R3:S1            -10.98
R3:S2            -21.39
R3:S3             14.46
R3:S4              0.00
R4:S1            -10.34
R4:S2             -8.49
R4:S3             18.78
R4:S4              0.00
R5:S1              0.00
R5:S2              0.00
R5:S3              0.00
R5:S4              0.00
R1:S1:Column1     54.97
R1:S1:Column2      5.27
R1:S1:Column3     10.94
R1:S1:Column4      8.05
R1:S1:Column5      0.00
R1:S2:Column1    -24.43
R1:S2:Column2    -78.73
```

```
R1:S2:Column3     15.88
R1:S2:Column4     -7.23
R1:S2:Column5      0.00
R1:S3:Column1    -11.99
R1:S3:Column2    -72.89
R1:S3:Column3    -26.10
R1:S3:Column4    -40.68
R1:S3:Column5      0.00
R1:S4:Column1      0.00
R1:S4:Column2      0.00
R1:S4:Column3      0.00
R1:S4:Column4      0.00
R1:S4:Column5      0.00
R2:S1:Column1     86.83
R2:S1:Column2     87.33
R2:S1:Column3     76.49
R2:S1:Column4      7.66
R2:S1:Column5      0.00
R2:S2:Column1     67.97
R2:S2:Column2      0.73
R2:S2:Column3     71.73
R2:S2:Column4     20.65
R2:S2:Column5      0.00
R2:S3:Column1     46.34
R2:S3:Column2     13.83
R2:S3:Column3     66.93
R2:S3:Column4     -2.28
R2:S3:Column5      0.00
R2:S4:Column1      0.00
R2:S4:Column2      0.00
R2:S4:Column3      0.00
R2:S4:Column4      0.00
R2:S4:Column5      0.00
R3:S1:Column1      7.17
R3:S1:Column2     52.01
R3:S1:Column3     51.42
R3:S1:Column4     -7.58
R3:S1:Column5      0.00
R3:S2:Column1     -5.38
R3:S2:Column2     12.88
R3:S2:Column3     83.94
R3:S2:Column4     26.47
R3:S2:Column5      0.00
R3:S3:Column1    -21.65
R3:S3:Column2    -75.11
R3:S3:Column3     32.21
R3:S3:Column4    -48.45
R3:S3:Column5      0.00
```

```
R3:S4:Column1      0.00
R3:S4:Column2      0.00
R3:S4:Column3      0.00
R3:S4:Column4      0.00
R3:S4:Column5      0.00
R4:S1:Column1     14.41
R4:S1:Column2     35.11
R4:S1:Column3     54.52
R4:S1:Column4    -31.57
R4:S1:Column5      0.00
R4:S2:Column1      6.58
R4:S2:Column2    -21.55
R4:S2:Column3     50.87
R4:S2:Column4     22.02
R4:S2:Column5      0.00
R4:S3:Column1     -4.47
R4:S3:Column2    -52.07
R4:S3:Column3     -2.11
R4:S3:Column4    -67.47
R4:S3:Column5      0.00
R4:S4:Column1      0.00
R4:S4:Column2      0.00
R4:S4:Column3      0.00
R4:S4:Column4      0.00
R4:S4:Column5      0.00
R5:S1:Column1      0.00
R5:S1:Column2      0.00
R5:S1:Column3      0.00
R5:S1:Column4      0.00
R5:S1:Column5      0.00
R5:S2:Column1      0.00
R5:S2:Column2      0.00
R5:S2:Column3      0.00
R5:S2:Column4      0.00
R5:S2:Column5      0.00
R5:S3:Column1      0.00
R5:S3:Column2      0.00
R5:S3:Column3      0.00
R5:S3:Column4      0.00
R5:S3:Column5      0.00
R5:S4:Column1      0.00
R5:S4:Column2      0.00
R5:S4:Column3      0.00
R5:S4:Column4      0.00
R5:S4:Column5      0.00
```

(73) MODEL

```
GLM(Y ~ Row + R + S + R:S + Row:R + Column:S + Column:R:S, ex2.2)
```

$ANOVA
Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	99	22310	225.36		
RESIDUALS	0	0			
CORRECTED TOTAL	99	22310			

$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Row	4	147.4	36.86		
R	4	1159.8	289.94		
S	3	351.9	117.29		
R:S	12	826.0	68.83		
Row:R	16	3979.8	248.74		
S:Column	12	3863.3	321.94		
R:S:Column	48	11982.3	249.63		

$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Row	0				
R	4	1159.8	289.94		
S	3	351.9	117.29		
R:S	12	826.0	68.83		
Row:R	0				
S:Column	12	3863.3	321.94		
R:S:Column	48	11982.3	249.63		

$`Type III`
CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Row	0				
R	4	1159.8	289.94		
S	3	351.9	117.29		
R:S	12	826.0	68.83		
Row:R	0				
S:Column	12	3863.3	321.94		
R:S:Column	48	11982.3	249.63		

$Parameter

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	1001.61			
Row1	-5.98			
Row2	16.88			
Row3	19.34			
Row4	-24.93			

```
Row5           0.00
R1             9.12
R2           -18.93
R3            -2.75
R4             3.02
R5             0.00
S1            24.26
S2            21.85
S3            -7.81
S4             0.00
R1:S1        -12.01
R1:S2         17.28
R1:S3         18.96
R1:S4          0.00
R2:S1        -39.64
R2:S2        -21.90
R2:S3        -31.42
R2:S4          0.00
R3:S1        -10.98
R3:S2        -21.39
R3:S3         14.46
R3:S4          0.00
R4:S1        -10.34
R4:S2         -8.49
R4:S3         18.78
R4:S4          0.00
R5:S1          0.00
R5:S2          0.00
R5:S3          0.00
R5:S4          0.00
Row1:R1        3.72
Row1:R2       14.16
Row1:R3      -24.63
Row1:R4        3.52
Row1:R5        0.00
Row2:R1      -61.81
Row2:R2       12.43
Row2:R3       -0.94
Row2:R4      -20.79
Row2:R5        0.00
Row3:R1      -56.60
Row3:R2      -12.11
Row3:R3      -30.06
Row3:R4       -4.44
Row3:R5        0.00
Row4:R1       46.95
Row4:R2       26.04
Row4:R3       43.63
```

```
Row4:R4          12.51
Row4:R5           0.00
Row5:R1           0.00
Row5:R2           0.00
Row5:R3           0.00
Row5:R4           0.00
Row5:R5           0.00
S1:Column1      -47.84
S1:Column2      -58.48
S1:Column3      -40.38
S1:Column4       10.08
S1:Column5        0.00
S2:Column1      -40.43
S2:Column2      -13.68
S2:Column3      -58.94
S2:Column4      -15.74
S2:Column5        0.00
S3:Column1       -0.39
S3:Column2       33.69
S3:Column3        5.46
S3:Column4       49.36
S3:Column5        0.00
S4:Column1        0.00
S4:Column2        0.00
S4:Column3        0.00
S4:Column4        0.00
S4:Column5        0.00
R1:S1:Column1    54.97
R1:S1:Column2     5.27
R1:S1:Column3    10.94
R1:S1:Column4     8.05
R1:S1:Column5     0.00
R1:S2:Column1   -24.43
R1:S2:Column2   -78.73
R1:S2:Column3    15.88
R1:S2:Column4    -7.23
R1:S2:Column5     0.00
R1:S3:Column1   -11.99
R1:S3:Column2   -72.89
R1:S3:Column3   -26.10
R1:S3:Column4   -40.68
R1:S3:Column5     0.00
R1:S4:Column1     0.00
R1:S4:Column2     0.00
R1:S4:Column3     0.00
R1:S4:Column4     0.00
R1:S4:Column5     0.00
R2:S1:Column1    86.83
```

```
R2:S1:Column2     87.33
R2:S1:Column3     76.49
R2:S1:Column4      7.66
R2:S1:Column5      0.00
R2:S2:Column1     67.97
R2:S2:Column2      0.73
R2:S2:Column3     71.73
R2:S2:Column4     20.65
R2:S2:Column5      0.00
R2:S3:Column1     46.34
R2:S3:Column2     13.83
R2:S3:Column3     66.93
R2:S3:Column4     -2.28
R2:S3:Column5      0.00
R2:S4:Column1      0.00
R2:S4:Column2      0.00
R2:S4:Column3      0.00
R2:S4:Column4      0.00
R2:S4:Column5      0.00
R3:S1:Column1      7.17
R3:S1:Column2     52.01
R3:S1:Column3     51.42
R3:S1:Column4     -7.58
R3:S1:Column5      0.00
R3:S2:Column1     -5.38
R3:S2:Column2     12.88
R3:S2:Column3     83.94
R3:S2:Column4     26.47
R3:S2:Column5      0.00
R3:S3:Column1    -21.65
R3:S3:Column2    -75.11
R3:S3:Column3     32.21
R3:S3:Column4    -48.45
R3:S3:Column5      0.00
R3:S4:Column1      0.00
R3:S4:Column2      0.00
R3:S4:Column3      0.00
R3:S4:Column4      0.00
R3:S4:Column5      0.00
R4:S1:Column1     14.41
R4:S1:Column2     35.11
R4:S1:Column3     54.52
R4:S1:Column4    -31.57
R4:S1:Column5      0.00
R4:S2:Column1      6.58
R4:S2:Column2    -21.55
R4:S2:Column3     50.87
R4:S2:Column4     22.02
```

```
R4:S2:Column5      0.00
R4:S3:Column1     -4.47
R4:S3:Column2    -52.07
R4:S3:Column3     -2.11
R4:S3:Column4    -67.47
R4:S3:Column5      0.00
R4:S4:Column1      0.00
R4:S4:Column2      0.00
R4:S4:Column3      0.00
R4:S4:Column4      0.00
R4:S4:Column5      0.00
R5:S1:Column1      0.00
R5:S1:Column2      0.00
R5:S1:Column3      0.00
R5:S1:Column4      0.00
R5:S1:Column5      0.00
R5:S2:Column1      0.00
R5:S2:Column2      0.00
R5:S2:Column3      0.00
R5:S2:Column4      0.00
R5:S2:Column5      0.00
R5:S3:Column1      0.00
R5:S3:Column2      0.00
R5:S3:Column3      0.00
R5:S3:Column4      0.00
R5:S3:Column5      0.00
R5:S4:Column1      0.00
R5:S4:Column2      0.00
R5:S4:Column3      0.00
R5:S4:Column4      0.00
R5:S4:Column5      0.00
```

```r
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(Y ~ Row + R + S + R:S + Row:R + Column:S + Column:R:S, ex2.2), type=3,
      singular.ok=TRUE) # NOT WORKING
```

7.5   Example 3.1

(74) MODEL

```r
ex3.1 = read.table("C:/G/Rt/Split/spedsite.txt", header=TRUE)
ex3.1 = af(ex3.1, c("Site", "A", "B", "C", "Block"))
GLM(Yield ~ Site + Site:Block + A + B + A:B + A:Site + B:Site + A:B:Site +
    A:B:Site:Block + C + A:C + B:C + A:B:C + C:Site + A:C:Site + B:C:Site +
    A:B:C:Site, ex3.1)
```

```
$ANOVA
Response : Yield
                  Df      Sum Sq   Mean Sq F value     Pr(>F)
MODEL            239 2724374186 11399055   23.682 < 2.2e-16 ***
RESIDUALS        240  115521933   481341
CORRECTED TOTAL 479 2839896119
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
                Df      Sum Sq    Mean Sq  F value   Pr(>F)
Site             3   621230991 207076997 430.2082 < 2e-16 ***
Site:Block       8  1305369943 163171243 338.9928 < 2e-16 ***
A                1     1333205   1333205   2.7698 0.09737 .
B                4    47928577  11982144  24.8932 < 2e-16 ***
A:B              4       14849      3712   0.0077 0.99988
Site:A           3       33010     11003   0.0229 0.99531
Site:B          12       37932      3161   0.0066 1.00000
Site:A:B        12       11494       958   0.0020 1.00000
Site:Block:A:B  72     8239680    114440   0.2378 1.00000
C                3   739890389 246630130 512.3809 < 2e-16 ***
A:C              3        3233      1078   0.0022 0.99985
B:C             12       34961      2913   0.0061 1.00000
A:B:C           12       11077       923   0.0019 1.00000
Site:C           9       25983      2887   0.0060 1.00000
Site:A:C         9       22227      2470   0.0051 1.00000
Site:B:C        36       88610      2461   0.0051 1.00000
Site:A:B:C      36       98025      2723   0.0057 1.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
                Df      Sum Sq    Mean Sq  F value   Pr(>F)
Site             3   621230991 207076997 430.2082 < 2e-16 ***
Site:Block       8  1305369943 163171243 338.9928 < 2e-16 ***
A                1     1333205   1333205   2.7698 0.09737 .
B                4    47928577  11982144  24.8932 < 2e-16 ***
A:B              4       14849      3712   0.0077 0.99988
Site:A           3       33010     11003   0.0229 0.99531
Site:B          12       37932      3161   0.0066 1.00000
Site:A:B        12       11494       958   0.0020 1.00000
Site:Block:A:B  72     8239680    114440   0.2378 1.00000
C                3   739890389 246630130 512.3809 < 2e-16 ***
A:C              3        3233      1078   0.0022 0.99985
B:C             12       34961      2913   0.0061 1.00000
A:B:C           12       11077       923   0.0019 1.00000
Site:C           9       25983      2887   0.0060 1.00000
Site:A:C         9       22227      2470   0.0051 1.00000
```

```
Site:B:C         36       88610       2461   0.0051 1.00000
Site:A:B:C       36       98025       2723   0.0057 1.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
               Df     Sum Sq    Mean Sq  F value  Pr(>F)
Site            3  621230991  207076997 430.2082 < 2e-16 ***
Site:Block      8 1305369943  163171243 338.9928 < 2e-16 ***
A               1    1333205    1333205   2.7698 0.09737 .
B               4   47928577   11982144  24.8932 < 2e-16 ***
A:B             4      14849       3712   0.0077 0.99988
Site:A          3      33010      11003   0.0229 0.99531
Site:B         12      37932       3161   0.0066 1.00000
Site:A:B       12      11494        958   0.0020 1.00000
Site:Block:A:B 72    8239680     114440   0.2378 1.00000
C               3  739890389  246630130 512.3809 < 2e-16 ***
A:C             3       3233       1078   0.0022 0.99985
B:C            12      34961       2913   0.0061 1.00000
A:B:C          12      11077        923   0.0019 1.00000
Site:C          9      25983       2887   0.0060 1.00000
Site:A:C        9      22227       2470   0.0051 1.00000
Site:B:C       36      88610       2461   0.0051 1.00000
Site:A:B:C     36      98025       2723   0.0057 1.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
                 Estimate Std. Error t value   Pr(>|t|)
(Intercept)        6915.2     490.58 14.0958 < 2.2e-16 ***
Site1               -54.7     693.79 -0.0788 0.9372617
Site2              2003.4     693.79  2.8877 0.0042356 **
Site3              2418.5     693.79  3.4859 0.0005830 ***
Site4                 0.0       0.00
Site1:BlockR1      4457.0     490.58  9.0851 < 2.2e-16 ***
Site1:BlockR2      2855.5     490.58  5.8206 1.868e-08 ***
Site1:BlockR3         0.0       0.00
Site2:BlockR1      4495.5     490.58  9.1636 < 2.2e-16 ***
Site2:BlockR2      2894.7     490.58  5.9006 1.226e-08 ***
Site2:BlockR3         0.0       0.00
Site3:BlockR1      4527.2     490.58  9.2283 < 2.2e-16 ***
Site3:BlockR2      2863.7     490.58  5.8375 1.710e-08 ***
Site3:BlockR3         0.0       0.00
Site4:BlockR1      4467.3     490.58  9.1060 < 2.2e-16 ***
Site4:BlockR2      2810.3     490.58  5.7284 3.022e-08 ***
Site4:BlockR3         0.0       0.00
AA1                 -91.2     693.79 -0.1315 0.8954707
AA2                   0.0       0.00
```

BB1	-442.7	693.79	-0.6380	0.5240537
BB2	-366.4	693.79	-0.5281	0.5978905
BB3	-224.9	693.79	-0.3242	0.7460791
BB4	-200.5	693.79	-0.2890	0.7728360
BB5	0.0	0.00		
AA1:BB1	56.4	981.16	0.0575	0.9541950
AA1:BB2	76.1	981.16	0.0775	0.9382554
AA1:BB3	-3.7	981.16	-0.0037	0.9970214
AA1:BB4	141.0	981.16	0.1437	0.8858525
AA1:BB5	0.0	0.00		
AA2:BB1	0.0	0.00		
AA2:BB2	0.0	0.00		
AA2:BB3	0.0	0.00		
AA2:BB4	0.0	0.00		
AA2:BB5	0.0	0.00		
Site1:AA1	70.5	981.16	0.0719	0.9427784
Site1:AA2	0.0	0.00		
Site2:AA1	-7.3	981.16	-0.0074	0.9941105
Site2:AA2	0.0	0.00		
Site3:AA1	64.6	981.16	0.0658	0.9475734
Site3:AA2	0.0	0.00		
Site4:AA1	0.0	0.00		
Site4:AA2	0.0	0.00		
Site1:BB1	99.7	981.16	0.1016	0.9191748
Site1:BB2	69.5	981.16	0.0708	0.9435887
Site1:BB3	127.2	981.16	0.1297	0.8969180
Site1:BB4	155.4	981.16	0.1584	0.8742746
Site1:BB5	0.0	0.00		
Site2:BB1	21.7	981.16	0.0222	0.9823327
Site2:BB2	4.6	981.16	0.0047	0.9962767
Site2:BB3	-3.7	981.16	-0.0037	0.9970214
Site2:BB4	66.5	981.16	0.0678	0.9460199
Site2:BB5	0.0	0.00		
Site3:BB1	55.6	981.16	0.0567	0.9548708
Site3:BB2	74.7	981.16	0.0762	0.9393354
Site3:BB3	53.5	981.16	0.0545	0.9565606
Site3:BB4	160.8	981.16	0.1639	0.8699313
Site3:BB5	0.0	0.00		
Site4:BB1	0.0	0.00		
Site4:BB2	0.0	0.00		
Site4:BB3	0.0	0.00		
Site4:BB4	0.0	0.00		
Site4:BB5	0.0	0.00		
Site1:AA1:BB1	-38.2	1387.58	-0.0276	0.9780312
Site1:AA1:BB2	-103.7	1387.58	-0.0747	0.9405072
Site1:AA1:BB3	-46.3	1387.58	-0.0334	0.9733901
Site1:AA1:BB4	-172.2	1387.58	-0.1241	0.9013579
Site1:AA1:BB5	0.0	0.00		

```
Site1:AA2:BB1              0.0       0.00
Site1:AA2:BB2              0.0       0.00
Site1:AA2:BB3              0.0       0.00
Site1:AA2:BB4              0.0       0.00
Site1:AA2:BB5              0.0       0.00
Site2:AA1:BB1            -47.2    1387.58 -0.0340 0.9729117
Site2:AA1:BB2            -26.1    1387.58 -0.0188 0.9850180
Site2:AA1:BB3             25.0    1387.58  0.0180 0.9856402
Site2:AA1:BB4           -109.2    1387.58 -0.0787 0.9373572
Site2:AA1:BB5              0.0       0.00
Site2:AA2:BB1              0.0       0.00
Site2:AA2:BB2              0.0       0.00
Site2:AA2:BB3              0.0       0.00
Site2:AA2:BB4              0.0       0.00
Site2:AA2:BB5              0.0       0.00
Site3:AA1:BB1            -48.0    1387.58 -0.0346 0.9724333
Site3:AA1:BB2            -87.7    1387.58 -0.0632 0.9496282
Site3:AA1:BB3              1.3    1387.58  0.0010 0.9992341
Site3:AA1:BB4            -86.4    1387.58 -0.0623 0.9503926
Site3:AA1:BB5              0.0       0.00
Site3:AA2:BB1              0.0       0.00
Site3:AA2:BB2              0.0       0.00
Site3:AA2:BB3              0.0       0.00
Site3:AA2:BB4              0.0       0.00
Site3:AA2:BB5              0.0       0.00
Site4:AA1:BB1              0.0       0.00
Site4:AA1:BB2              0.0       0.00
Site4:AA1:BB3              0.0       0.00
Site4:AA1:BB4              0.0       0.00
Site4:AA1:BB5              0.0       0.00
Site4:AA2:BB1              0.0       0.00
Site4:AA2:BB2              0.0       0.00
Site4:AA2:BB3              0.0       0.00
Site4:AA2:BB4              0.0       0.00
Site4:AA2:BB5              0.0       0.00
Site1:BlockR1:AA1:BB1  -928.2     693.79 -1.3379 0.1821806
Site1:BlockR1:AA1:BB2  -733.2     693.79 -1.0569 0.2916292
Site1:BlockR1:AA1:BB3  -514.0     693.79 -0.7409 0.4595022
Site1:BlockR1:AA1:BB4  -350.2     693.79 -0.5048 0.6141363
Site1:BlockR1:AA1:BB5  -106.7     693.79 -0.1539 0.8778451
Site1:BlockR1:AA2:BB1  -900.7     693.79 -1.2983 0.1954278
Site1:BlockR1:AA2:BB2  -683.7     693.79 -0.9855 0.3253553
Site1:BlockR1:AA2:BB3  -415.7     693.79 -0.5992 0.5495736
Site1:BlockR1:AA2:BB4  -216.5     693.79 -0.3121 0.7552696
Site1:BlockR1:AA2:BB5     0.0       0.00
Site1:BlockR2:AA1:BB1  -744.0     693.79 -1.0724 0.2846291
Site1:BlockR2:AA1:BB2  -533.0     693.79 -0.7682 0.4430960
Site1:BlockR2:AA1:BB3  -417.7     693.79 -0.6021 0.5476564
```

```
Site1:BlockR2:AA1:BB4   -277.7      693.79 -0.4003 0.6892633
Site1:BlockR2:AA1:BB5    -80.0      693.79 -0.1153 0.9082966
Site1:BlockR2:AA2:BB1   -713.2      693.79 -1.0281 0.3049602
Site1:BlockR2:AA2:BB2   -488.5      693.79 -0.7041 0.4820495
Site1:BlockR2:AA2:BB3   -373.2      693.79 -0.5380 0.5910833
Site1:BlockR2:AA2:BB4   -231.2      693.79 -0.3333 0.7391874
Site1:BlockR2:AA2:BB5      0.0        0.00
Site1:BlockR3:AA1:BB1      0.0        0.00
Site1:BlockR3:AA1:BB2      0.0        0.00
Site1:BlockR3:AA1:BB3      0.0        0.00
Site1:BlockR3:AA1:BB4      0.0        0.00
Site1:BlockR3:AA1:BB5      0.0        0.00
Site1:BlockR3:AA2:BB1      0.0        0.00
Site1:BlockR3:AA2:BB2      0.0        0.00
Site1:BlockR3:AA2:BB3      0.0        0.00
Site1:BlockR3:AA2:BB4      0.0        0.00
Site1:BlockR3:AA2:BB5      0.0        0.00
Site2:BlockR1:AA1:BB1   -974.5      693.79 -1.4046 0.1614307
Site2:BlockR1:AA1:BB2   -779.5      693.79 -1.1235 0.2623297
Site2:BlockR1:AA1:BB3   -559.5      693.79 -0.8064 0.4207860
Site2:BlockR1:AA1:BB4   -301.0      693.79 -0.4339 0.6647869
Site2:BlockR1:AA1:BB5   -172.0      693.79 -0.2479 0.8044126
Site2:BlockR1:AA2:BB1   -878.8      693.79 -1.2666 0.2065270
Site2:BlockR1:AA2:BB2   -603.5      693.79 -0.8699 0.3852446
Site2:BlockR1:AA2:BB3   -392.3      693.79 -0.5654 0.5723471
Site2:BlockR1:AA2:BB4   -212.5      693.79 -0.3063 0.7596497
Site2:BlockR1:AA2:BB5      0.0        0.00
Site2:BlockR2:AA1:BB1   -725.0      693.79 -1.0450 0.2970798
Site2:BlockR2:AA1:BB2   -572.5      693.79 -0.8252 0.4100886
Site2:BlockR2:AA1:BB3   -427.2      693.79 -0.6158 0.5385953
Site2:BlockR2:AA1:BB4   -278.0      693.79 -0.4007 0.6889983
Site2:BlockR2:AA1:BB5   -144.5      693.79 -0.2083 0.8351894
Site2:BlockR2:AA2:BB1   -629.5      693.79 -0.9073 0.3651382
Site2:BlockR2:AA2:BB2   -530.0      693.79 -0.7639 0.4456638
Site2:BlockR2:AA2:BB3   -304.0      693.79 -0.4382 0.6616540
Site2:BlockR2:AA2:BB4   -204.5      693.79 -0.2948 0.7684330
Site2:BlockR2:AA2:BB5      0.0        0.00
Site2:BlockR3:AA1:BB1      0.0        0.00
Site2:BlockR3:AA1:BB2      0.0        0.00
Site2:BlockR3:AA1:BB3      0.0        0.00
Site2:BlockR3:AA1:BB4      0.0        0.00
Site2:BlockR3:AA1:BB5      0.0        0.00
Site2:BlockR3:AA2:BB1      0.0        0.00
Site2:BlockR3:AA2:BB2      0.0        0.00
Site2:BlockR3:AA2:BB3      0.0        0.00
Site2:BlockR3:AA2:BB4      0.0        0.00
Site2:BlockR3:AA2:BB5      0.0        0.00
Site3:BlockR1:AA1:BB1  -1029.0      693.79 -1.4832 0.1393432
```

```
Site3:BlockR1:AA1:BB2   -781.0      693.79 -1.1257 0.2614150
Site3:BlockR1:AA1:BB3   -555.2      693.79 -0.8003 0.4243187
Site3:BlockR1:AA1:BB4   -442.5      693.79 -0.6378 0.5242099
Site3:BlockR1:AA1:BB5   -152.7      693.79 -0.2202 0.8259273
Site3:BlockR1:AA2:BB1   -858.5      693.79 -1.2374 0.2171441
Site3:BlockR1:AA2:BB2   -683.7      693.79 -0.9855 0.3253553
Site3:BlockR1:AA2:BB3   -453.7      693.79 -0.6540 0.5137261
Site3:BlockR1:AA2:BB4   -213.2      693.79 -0.3074 0.7588278
Site3:BlockR1:AA2:BB5      0.0        0.00
Site3:BlockR2:AA1:BB1   -756.0      693.79 -1.0897 0.2769512
Site3:BlockR2:AA1:BB2   -566.0      693.79 -0.8158 0.4154169
Site3:BlockR2:AA1:BB3   -354.5      693.79 -0.5110 0.6098465
Site3:BlockR2:AA1:BB4   -266.2      693.79 -0.3838 0.7014939
Site3:BlockR2:AA1:BB5    -87.2      693.79 -0.1258 0.9000280
Site3:BlockR2:AA2:BB1   -619.2      693.79 -0.8926 0.3729847
Site3:BlockR2:AA2:BB2   -448.2      693.79 -0.6461 0.5188377
Site3:BlockR2:AA2:BB3   -261.0      693.79 -0.3762 0.7071037
Site3:BlockR2:AA2:BB4   -175.7      693.79 -0.2533 0.8002381
Site3:BlockR2:AA2:BB5      0.0        0.00
Site3:BlockR3:AA1:BB1      0.0        0.00
Site3:BlockR3:AA1:BB2      0.0        0.00
Site3:BlockR3:AA1:BB3      0.0        0.00
Site3:BlockR3:AA1:BB4      0.0        0.00
Site3:BlockR3:AA1:BB5      0.0        0.00
Site3:BlockR3:AA2:BB1      0.0        0.00
Site3:BlockR3:AA2:BB2      0.0        0.00
Site3:BlockR3:AA2:BB3      0.0        0.00
Site3:BlockR3:AA2:BB4      0.0        0.00
Site3:BlockR3:AA2:BB5      0.0        0.00
Site4:BlockR1:AA1:BB1   -920.0      693.79 -1.3261 0.1860824
Site4:BlockR1:AA1:BB2   -756.0      693.79 -1.0897 0.2769512
Site4:BlockR1:AA1:BB3   -550.5      693.79 -0.7935 0.4282876
Site4:BlockR1:AA1:BB4   -312.5      693.79 -0.4504 0.6528099
Site4:BlockR1:AA1:BB5    -94.0      693.79 -0.1355 0.8923395
Site4:BlockR1:AA2:BB1   -825.8      693.79 -1.1902 0.2351416
Site4:BlockR1:AA2:BB2   -603.3      693.79 -0.8695 0.3854412
Site4:BlockR1:AA2:BB3   -425.0      693.79 -0.6126 0.5407345
Site4:BlockR1:AA2:BB4   -154.8      693.79 -0.2231 0.8236856
Site4:BlockR1:AA2:BB5      0.0        0.00
Site4:BlockR2:AA1:BB1   -664.5      693.79 -0.9578 0.3391346
Site4:BlockR2:AA1:BB2   -552.3      693.79 -0.7960 0.4268228
Site4:BlockR2:AA1:BB3   -366.0      693.79 -0.5275 0.5983068
Site4:BlockR2:AA1:BB4   -213.3      693.79 -0.3074 0.7588278
Site4:BlockR2:AA1:BB5     -1.3      693.79 -0.0018 0.9985639
Site4:BlockR2:AA2:BB1   -547.3      693.79 -0.7888 0.4310156
Site4:BlockR2:AA2:BB2   -434.5      693.79 -0.6263 0.5317316
Site4:BlockR2:AA2:BB3   -320.3      693.79 -0.4616 0.6447888
Site4:BlockR2:AA2:BB4    -79.8      693.79 -0.1149 0.9085819
```

```
Site4:BlockR2:AA2:BB5       0.0        0.00
Site4:BlockR3:AA1:BB1       0.0        0.00
Site4:BlockR3:AA1:BB2       0.0        0.00
Site4:BlockR3:AA1:BB3       0.0        0.00
Site4:BlockR3:AA1:BB4       0.0        0.00
Site4:BlockR3:AA1:BB5       0.0        0.00
Site4:BlockR3:AA2:BB1       0.0        0.00
Site4:BlockR3:AA2:BB2       0.0        0.00
Site4:BlockR3:AA2:BB3       0.0        0.00
Site4:BlockR3:AA2:BB4       0.0        0.00
Site4:BlockR3:AA2:BB5       0.0        0.00
CC1                     -3320.7      566.48 -5.8620 1.503e-08 ***
CC2                     -2205.0      566.48 -3.8925 0.0001286 ***
CC3                     -1108.0      566.48 -1.9560 0.0516306 .
CC4                         0.0        0.00
AA1:CC1                    -1.7      801.12 -0.0021 0.9983418
AA1:CC2                   -17.0      801.12 -0.0212 0.9830875
AA1:CC3                    21.7      801.12  0.0270 0.9784459
AA1:CC4                     0.0        0.00
AA2:CC1                     0.0        0.00
AA2:CC2                     0.0        0.00
AA2:CC3                     0.0        0.00
AA2:CC4                     0.0        0.00
BB1:CC1                   -36.7      801.12 -0.0458 0.9635321
BB1:CC2                   -13.0      801.12 -0.0162 0.9870665
BB1:CC3                    13.3      801.12  0.0166 0.9867349
BB1:CC4                     0.0        0.00
BB2:CC1                   -28.0      801.12 -0.0350 0.9721477
BB2:CC2                    27.7      801.12  0.0345 0.9724791
BB2:CC3                    62.0      801.12  0.0774 0.9383762
BB2:CC4                     0.0        0.00
BB3:CC1                   -21.0      801.12 -0.0262 0.9791089
BB3:CC2                    20.3      801.12  0.0254 0.9797720
BB3:CC3                    36.3      801.12  0.0454 0.9638634
BB3:CC4                     0.0        0.00
BB4:CC1                    18.7      801.12  0.0233 0.9814297
BB4:CC2                    28.0      801.12  0.0350 0.9721477
BB4:CC3                    84.3      801.12  0.1053 0.9162497
BB4:CC4                     0.0        0.00
BB5:CC1                     0.0        0.00
BB5:CC2                     0.0        0.00
BB5:CC3                     0.0        0.00
BB5:CC4                     0.0        0.00
AA1:BB1:CC1                51.7     1132.95  0.0456 0.9636641
AA1:BB1:CC2                 7.7     1132.95  0.0068 0.9946064
AA1:BB1:CC3               -16.0     1132.95 -0.0141 0.9887440
AA1:BB1:CC4                 0.0        0.00
AA1:BB2:CC1                51.3     1132.95  0.0453 0.9638984
```

```
AA1:BB2:CC2          -52.3     1132.95 -0.0462 0.9631956
AA1:BB2:CC3          -88.3     1132.95 -0.0780 0.9379189
AA1:BB2:CC4            0.0        0.00
AA1:BB3:CC1           97.3     1132.95  0.0859 0.9316085
AA1:BB3:CC2           74.0     1132.95  0.0653 0.9479766
AA1:BB3:CC3          -26.7     1132.95 -0.0235 0.9812412
AA1:BB3:CC4            0.0        0.00
AA1:BB4:CC1          -78.0     1132.95 -0.0688 0.9451689
AA1:BB4:CC2          -27.7     1132.95 -0.0244 0.9805379
AA1:BB4:CC3          -67.3     1132.95 -0.0594 0.9526576
AA1:BB4:CC4            0.0        0.00
AA1:BB5:CC1            0.0        0.00
AA1:BB5:CC2            0.0        0.00
AA1:BB5:CC3            0.0        0.00
AA1:BB5:CC4            0.0        0.00
AA2:BB1:CC1            0.0        0.00
AA2:BB1:CC2            0.0        0.00
AA2:BB1:CC3            0.0        0.00
AA2:BB1:CC4            0.0        0.00
AA2:BB2:CC1            0.0        0.00
AA2:BB2:CC2            0.0        0.00
AA2:BB2:CC3            0.0        0.00
AA2:BB2:CC4            0.0        0.00
AA2:BB3:CC1            0.0        0.00
AA2:BB3:CC2            0.0        0.00
AA2:BB3:CC3            0.0        0.00
AA2:BB3:CC4            0.0        0.00
AA2:BB4:CC1            0.0        0.00
AA2:BB4:CC2            0.0        0.00
AA2:BB4:CC3            0.0        0.00
AA2:BB4:CC4            0.0        0.00
AA2:BB5:CC1            0.0        0.00
AA2:BB5:CC2            0.0        0.00
AA2:BB5:CC3            0.0        0.00
AA2:BB5:CC4            0.0        0.00
Site1:CC1            31.3      801.12  0.0391 0.9688336
Site1:CC2            26.7      801.12  0.0333 0.9734735
Site1:CC3            26.7      801.12  0.0333 0.9734735
Site1:CC4             0.0        0.00
Site2:CC1           -29.0      801.12 -0.0362 0.9711534
Site2:CC2           -72.3      801.12 -0.0903 0.9281316
Site2:CC3           -10.3      801.12 -0.0129 0.9897194
Site2:CC4             0.0        0.00
Site3:CC1             1.7      801.12  0.0021 0.9983418
Site3:CC2            -7.0      801.12 -0.0087 0.9930356
Site3:CC3           -15.7      801.12 -0.0196 0.9844138
Site3:CC4             0.0        0.00
Site4:CC1             0.0        0.00
```

```
Site4:CC2                    0.0        0.00
Site4:CC3                    0.0        0.00
Site4:CC4                    0.0        0.00
Site1:AA1:CC1              -10.0     1132.95 -0.0088 0.9929649
Site1:AA1:CC2              -15.0     1132.95 -0.0132 0.9894475
Site1:AA1:CC3              -29.0     1132.95 -0.0256 0.9796001
Site1:AA1:CC4               0.0        0.00
Site1:AA2:CC1               0.0        0.00
Site1:AA2:CC2               0.0        0.00
Site1:AA2:CC3               0.0        0.00
Site1:AA2:CC4               0.0        0.00
Site2:AA1:CC1              62.0      1132.95  0.0547 0.9564036
Site2:AA1:CC2             156.7      1132.95  0.1383 0.8901335
Site2:AA1:CC3             -20.7      1132.95 -0.0182 0.9854614
Site2:AA1:CC4               0.0        0.00
Site2:AA2:CC1               0.0        0.00
Site2:AA2:CC2               0.0        0.00
Site2:AA2:CC3               0.0        0.00
Site2:AA2:CC4               0.0        0.00
Site3:AA1:CC1             -48.0      1132.95 -0.0424 0.9662412
Site3:AA1:CC2               9.0      1132.95  0.0079 0.9936684
Site3:AA1:CC3              48.7      1132.95  0.0430 0.9657726
Site3:AA1:CC4               0.0        0.00
Site3:AA2:CC1               0.0        0.00
Site3:AA2:CC2               0.0        0.00
Site3:AA2:CC3               0.0        0.00
Site3:AA2:CC4               0.0        0.00
Site4:AA1:CC1               0.0        0.00
Site4:AA1:CC2               0.0        0.00
Site4:AA1:CC3               0.0        0.00
Site4:AA1:CC4               0.0        0.00
Site4:AA2:CC1               0.0        0.00
Site4:AA2:CC2               0.0        0.00
Site4:AA2:CC3               0.0        0.00
Site4:AA2:CC4               0.0        0.00
Site1:BB1:CC1              -6.0      1132.95 -0.0053 0.9957789
Site1:BB1:CC2             -62.0      1132.95 -0.0547 0.9564036
Site1:BB1:CC3               6.3      1132.95  0.0056 0.9955444
Site1:BB1:CC4               0.0        0.00
Site1:BB2:CC1              61.0      1132.95  0.0538 0.9571061
Site1:BB2:CC2             -57.0      1132.95 -0.0503 0.9599163
Site1:BB2:CC3             -38.0      1132.95 -0.0335 0.9732713
Site1:BB2:CC4               0.0        0.00
Site1:BB3:CC1             -85.7      1132.95 -0.0756 0.9397894
Site1:BB3:CC2            -116.0      1132.95 -0.1024 0.9185346
Site1:BB3:CC3            -108.3      1132.95 -0.0956 0.9239018
Site1:BB3:CC4               0.0        0.00
Site1:BB4:CC1             -74.7      1132.95 -0.0659 0.9475086
```

```
Site1:BB4:CC2          -36.7     1132.95 -0.0324 0.9742088
Site1:BB4:CC3         -138.3     1132.95 -0.1221 0.9029220
Site1:BB4:CC4            0.0        0.00
Site1:BB5:CC1            0.0        0.00
Site1:BB5:CC2            0.0        0.00
Site1:BB5:CC3            0.0        0.00
Site1:BB5:CC4            0.0        0.00
Site2:BB1:CC1           59.3     1132.95  0.0524 0.9582769
Site2:BB1:CC2           43.0     1132.95  0.0380 0.9697559
Site2:BB1:CC3           18.7     1132.95  0.0165 0.9868682
Site2:BB1:CC4            0.0        0.00
Site2:BB2:CC1           54.3     1132.95  0.0480 0.9617901
Site2:BB2:CC2           95.3     1132.95  0.0841 0.9330104
Site2:BB2:CC3          -54.0     1132.95 -0.0477 0.9620243
Site2:BB2:CC4            0.0        0.00
Site2:BB3:CC1          -55.3     1132.95 -0.0488 0.9610874
Site2:BB3:CC2           81.3     1132.95  0.0718 0.9428297
Site2:BB3:CC3           -2.3     1132.95 -0.0021 0.9983585
Site2:BB3:CC4            0.0        0.00
Site2:BB4:CC1          -32.0     1132.95 -0.0282 0.9774904
Site2:BB4:CC2           13.0     1132.95  0.0115 0.9908544
Site2:BB4:CC3          -63.0     1132.95 -0.0556 0.9557011
Site2:BB4:CC4            0.0        0.00
Site2:BB5:CC1            0.0        0.00
Site2:BB5:CC2            0.0        0.00
Site2:BB5:CC3            0.0        0.00
Site2:BB5:CC4            0.0        0.00
Site3:BB1:CC1           39.3     1132.95  0.0347 0.9723338
Site3:BB1:CC2           19.0     1132.95  0.0168 0.9866337
Site3:BB1:CC3           19.3     1132.95  0.0171 0.9863993
Site3:BB1:CC4            0.0        0.00
Site3:BB2:CC1           73.3     1132.95  0.0647 0.9484447
Site3:BB2:CC2          -66.0     1132.95 -0.0583 0.9535940
Site3:BB2:CC3          -28.3     1132.95 -0.0250 0.9800690
Site3:BB2:CC4            0.0        0.00
Site3:BB3:CC1            1.3     1132.95  0.0012 0.9990620
Site3:BB3:CC2          -49.0     1132.95 -0.0432 0.9655383
Site3:BB3:CC3           26.7     1132.95  0.0235 0.9812412
Site3:BB3:CC4            0.0        0.00
Site3:BB4:CC1          -61.0     1132.95 -0.0538 0.9571061
Site3:BB4:CC2          -65.7     1132.95 -0.0580 0.9538281
Site3:BB4:CC3         -103.7     1132.95 -0.0915 0.9271704
Site3:BB4:CC4            0.0        0.00
Site3:BB5:CC1            0.0        0.00
Site3:BB5:CC2            0.0        0.00
Site3:BB5:CC3            0.0        0.00
Site3:BB5:CC4            0.0        0.00
Site4:BB1:CC1            0.0        0.00
```

```
Site4:BB1:CC2              0.0      0.00
Site4:BB1:CC3              0.0      0.00
Site4:BB1:CC4              0.0      0.00
Site4:BB2:CC1              0.0      0.00
Site4:BB2:CC2              0.0      0.00
Site4:BB2:CC3              0.0      0.00
Site4:BB2:CC4              0.0      0.00
Site4:BB3:CC1              0.0      0.00
Site4:BB3:CC2              0.0      0.00
Site4:BB3:CC3              0.0      0.00
Site4:BB3:CC4              0.0      0.00
Site4:BB4:CC1              0.0      0.00
Site4:BB4:CC2              0.0      0.00
Site4:BB4:CC3              0.0      0.00
Site4:BB4:CC4              0.0      0.00
Site4:BB5:CC1              0.0      0.00
Site4:BB5:CC2              0.0      0.00
Site4:BB5:CC3              0.0      0.00
Site4:BB5:CC4              0.0      0.00
Site1:AA1:BB1:CC1        -66.7   1602.23 -0.0416 0.9668453
Site1:AA1:BB1:CC2        -16.3   1602.23 -0.0102 0.9918749
Site1:AA1:BB1:CC3        -86.0   1602.23 -0.0537 0.9572387
Site1:AA1:BB1:CC4          0.0      0.00
Site1:AA1:BB2:CC1        -31.0   1602.23 -0.0193 0.9845796
Site1:AA1:BB2:CC2         81.3   1602.23  0.0508 0.9595570
Site1:AA1:BB2:CC3         58.3   1602.23  0.0364 0.9709877
Site1:AA1:BB2:CC4          0.0      0.00
Site1:AA1:BB3:CC1       -103.3   1602.23 -0.0645 0.9486311
Site1:AA1:BB3:CC2         -3.7   1602.23 -0.0023 0.9981760
Site1:AA1:BB3:CC3         45.3   1602.23  0.0283 0.9774513
Site1:AA1:BB3:CC4          0.0      0.00
Site1:AA1:BB4:CC1        137.3   1602.23  0.0857 0.9317655
Site1:AA1:BB4:CC2         69.3   1602.23  0.0433 0.9655200
Site1:AA1:BB4:CC3        137.0   1602.23  0.0855 0.9319307
Site1:AA1:BB4:CC4          0.0      0.00
Site1:AA1:BB5:CC1          0.0      0.00
Site1:AA1:BB5:CC2          0.0      0.00
Site1:AA1:BB5:CC3          0.0      0.00
Site1:AA1:BB5:CC4          0.0      0.00
Site1:AA2:BB1:CC1          0.0      0.00
Site1:AA2:BB1:CC2          0.0      0.00
Site1:AA2:BB1:CC3          0.0      0.00
Site1:AA2:BB1:CC4          0.0      0.00
Site1:AA2:BB2:CC1          0.0      0.00
Site1:AA2:BB2:CC2          0.0      0.00
Site1:AA2:BB2:CC3          0.0      0.00
Site1:AA2:BB2:CC4          0.0      0.00
Site1:AA2:BB3:CC1          0.0      0.00
```

```
Site1:AA2:BB3:CC2          0.0          0.00
Site1:AA2:BB3:CC3          0.0          0.00
Site1:AA2:BB3:CC4          0.0          0.00
Site1:AA2:BB4:CC1          0.0          0.00
Site1:AA2:BB4:CC2          0.0          0.00
Site1:AA2:BB4:CC3          0.0          0.00
Site1:AA2:BB4:CC4          0.0          0.00
Site1:AA2:BB5:CC1          0.0          0.00
Site1:AA2:BB5:CC2          0.0          0.00
Site1:AA2:BB5:CC3          0.0          0.00
Site1:AA2:BB5:CC4          0.0          0.00
Site2:AA1:BB1:CC1       -130.0       1602.23 -0.0811 0.9354009
Site2:AA1:BB1:CC2        -79.0       1602.23 -0.0493 0.9607163
Site2:AA1:BB1:CC3         17.7       1602.23  0.0110 0.9912116
Site2:AA1:BB1:CC4          0.0          0.00
Site2:AA1:BB2:CC1       -128.0       1602.23 -0.0799 0.9363925
Site2:AA1:BB2:CC2        -92.0       1602.23 -0.0574 0.9542585
Site2:AA1:BB2:CC3        160.3       1602.23  0.1001 0.9203734
Site2:AA1:BB2:CC4          0.0          0.00
Site2:AA1:BB3:CC1        -49.0       1602.23 -0.0306 0.9756281
Site2:AA1:BB3:CC2       -220.3       1602.23 -0.1375 0.8907380
Site2:AA1:BB3:CC3         51.3       1602.23  0.0320 0.9744679
Site2:AA1:BB3:CC4          0.0          0.00
Site2:AA1:BB4:CC1         60.7       1602.23  0.0379 0.9698278
Site2:AA1:BB4:CC2        -81.7       1602.23 -0.0510 0.9593914
Site2:AA1:BB4:CC3         37.7       1602.23  0.0235 0.9812639
Site2:AA1:BB4:CC4          0.0          0.00
Site2:AA1:BB5:CC1          0.0          0.00
Site2:AA1:BB5:CC2          0.0          0.00
Site2:AA1:BB5:CC3          0.0          0.00
Site2:AA1:BB5:CC4          0.0          0.00
Site2:AA2:BB1:CC1          0.0          0.00
Site2:AA2:BB1:CC2          0.0          0.00
Site2:AA2:BB1:CC3          0.0          0.00
Site2:AA2:BB1:CC4          0.0          0.00
Site2:AA2:BB2:CC1          0.0          0.00
Site2:AA2:BB2:CC2          0.0          0.00
Site2:AA2:BB2:CC3          0.0          0.00
Site2:AA2:BB2:CC4          0.0          0.00
Site2:AA2:BB3:CC1          0.0          0.00
Site2:AA2:BB3:CC2          0.0          0.00
Site2:AA2:BB3:CC3          0.0          0.00
Site2:AA2:BB3:CC4          0.0          0.00
Site2:AA2:BB4:CC1          0.0          0.00
Site2:AA2:BB4:CC2          0.0          0.00
Site2:AA2:BB4:CC3          0.0          0.00
Site2:AA2:BB4:CC4          0.0          0.00
Site2:AA2:BB5:CC1          0.0          0.00
```

```
Site2:AA2:BB5:CC2          0.0        0.00
Site2:AA2:BB5:CC3          0.0        0.00
Site2:AA2:BB5:CC4          0.0        0.00
Site3:AA1:BB1:CC1         60.7     1602.23   0.0379 0.9698278
Site3:AA1:BB1:CC2         -3.3     1602.23  -0.0021 0.9983418
Site3:AA1:BB1:CC3         -8.3     1602.23  -0.0052 0.9958545
Site3:AA1:BB1:CC4          0.0        0.00
Site3:AA1:BB2:CC1        -47.3     1602.23  -0.0295 0.9764568
Site3:AA1:BB2:CC2        138.0     1602.23   0.0861 0.9314351
Site3:AA1:BB2:CC3         44.3     1602.23   0.0277 0.9779486
Site3:AA1:BB2:CC4          0.0        0.00
Site3:AA1:BB3:CC1        -51.7     1602.23  -0.0322 0.9743022
Site3:AA1:BB3:CC2        -49.0     1602.23  -0.0306 0.9756281
Site3:AA1:BB3:CC3        -70.7     1602.23  -0.0441 0.9648573
Site3:AA1:BB3:CC4          0.0        0.00
Site3:AA1:BB4:CC1        114.0     1602.23   0.0712 0.9433371
Site3:AA1:BB4:CC2         45.0     1602.23   0.0281 0.9776171
Site3:AA1:BB4:CC3         19.7     1602.23   0.0123 0.9902168
Site3:AA1:BB4:CC4          0.0        0.00
Site3:AA1:BB5:CC1          0.0        0.00
Site3:AA1:BB5:CC2          0.0        0.00
Site3:AA1:BB5:CC3          0.0        0.00
Site3:AA1:BB5:CC4          0.0        0.00
Site3:AA2:BB1:CC1          0.0        0.00
Site3:AA2:BB1:CC2          0.0        0.00
Site3:AA2:BB1:CC3          0.0        0.00
Site3:AA2:BB1:CC4          0.0        0.00
Site3:AA2:BB2:CC1          0.0        0.00
Site3:AA2:BB2:CC2          0.0        0.00
Site3:AA2:BB2:CC3          0.0        0.00
Site3:AA2:BB2:CC4          0.0        0.00
Site3:AA2:BB3:CC1          0.0        0.00
Site3:AA2:BB3:CC2          0.0        0.00
Site3:AA2:BB3:CC3          0.0        0.00
Site3:AA2:BB3:CC4          0.0        0.00
Site3:AA2:BB4:CC1          0.0        0.00
Site3:AA2:BB4:CC2          0.0        0.00
Site3:AA2:BB4:CC3          0.0        0.00
Site3:AA2:BB4:CC4          0.0        0.00
Site3:AA2:BB5:CC1          0.0        0.00
Site3:AA2:BB5:CC2          0.0        0.00
Site3:AA2:BB5:CC3          0.0        0.00
Site3:AA2:BB5:CC4          0.0        0.00
Site4:AA1:BB1:CC1          0.0        0.00
Site4:AA1:BB1:CC2          0.0        0.00
Site4:AA1:BB1:CC3          0.0        0.00
Site4:AA1:BB1:CC4          0.0        0.00
Site4:AA1:BB2:CC1          0.0        0.00
```

```
Site4:AA1:BB2:CC2          0.0          0.00
Site4:AA1:BB2:CC3          0.0          0.00
Site4:AA1:BB2:CC4          0.0          0.00
Site4:AA1:BB3:CC1          0.0          0.00
Site4:AA1:BB3:CC2          0.0          0.00
Site4:AA1:BB3:CC3          0.0          0.00
Site4:AA1:BB3:CC4          0.0          0.00
Site4:AA1:BB4:CC1          0.0          0.00
Site4:AA1:BB4:CC2          0.0          0.00
Site4:AA1:BB4:CC3          0.0          0.00
Site4:AA1:BB4:CC4          0.0          0.00
Site4:AA1:BB5:CC1          0.0          0.00
Site4:AA1:BB5:CC2          0.0          0.00
Site4:AA1:BB5:CC3          0.0          0.00
Site4:AA1:BB5:CC4          0.0          0.00
Site4:AA2:BB1:CC1          0.0          0.00
Site4:AA2:BB1:CC2          0.0          0.00
Site4:AA2:BB1:CC3          0.0          0.00
Site4:AA2:BB1:CC4          0.0          0.00
Site4:AA2:BB2:CC1          0.0          0.00
Site4:AA2:BB2:CC2          0.0          0.00
Site4:AA2:BB2:CC3          0.0          0.00
Site4:AA2:BB2:CC4          0.0          0.00
Site4:AA2:BB3:CC1          0.0          0.00
Site4:AA2:BB3:CC2          0.0          0.00
Site4:AA2:BB3:CC3          0.0          0.00
Site4:AA2:BB3:CC4          0.0          0.00
Site4:AA2:BB4:CC1          0.0          0.00
Site4:AA2:BB4:CC2          0.0          0.00
Site4:AA2:BB4:CC3          0.0          0.00
Site4:AA2:BB4:CC4          0.0          0.00
Site4:AA2:BB5:CC1          0.0          0.00
Site4:AA2:BB5:CC2          0.0          0.00
Site4:AA2:BB5:CC3          0.0          0.00
Site4:AA2:BB5:CC4          0.0          0.00
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(75) MODEL

```r
ex3.1a = read.table("C:/G/Rt/Split/Ex3.1-example.txt", header=TRUE)
ex3.1a = af(ex3.1a, c("row", "P", "column", "R", "S"))
GLM(height ~ P + column + column:P + R + P:R + column:R + column:R:P + S +
   P:S + column:S + column:S:P + R:S + R:S:column + R:S:P + R:S:P:column, ex3.1a)
```

```
$ANOVA
Response : height
```

```
                 Df Sum Sq Mean Sq F value Pr(>F)
MODEL            199 7534.8  37.863
RESIDUALS          0    0.0
CORRECTED TOTAL  199 7534.8
```

$`Type I`
```
               Df Sum Sq Mean Sq F value Pr(>F)
P               1  253.1 253.125
column          4  109.4  27.357
P:column        4  207.9  51.987
R               4   90.6  22.657
P:R             4  505.0 126.238
column:R       16 3357.8 209.864
P:column:R     16 1442.6  90.163
S               3   16.4   5.458
P:S             3   14.3   4.765
column:S       12  265.4  22.121
P:column:S     12   96.5   8.044
R:S            12  195.1  16.254
column:R:S     48  365.5   7.615
P:R:S          12  100.3   8.361
P:column:R:S   48  514.7  10.723
```

$`Type II`
```
               Df Sum Sq Mean Sq F value Pr(>F)
P               1  253.1 253.125
column          4  109.4  27.358
P:column        4  208.0  51.988
R               4   90.6  22.657
P:R             4  504.9 126.237
column:R       16 3357.8 209.864
P:column:R     16 1442.6  90.162
S               3   16.4   5.458
P:S             3   14.3   4.765
column:S       12  265.5  22.121
P:column:S     12   96.5   8.044
R:S            12  195.0  16.254
column:R:S     48  365.5   7.615
P:R:S          12  100.3   8.361
P:column:R:S   48  514.7  10.723
```

$`Type III`
```
               Df Sum Sq Mean Sq F value Pr(>F)
P               1  253.1 253.125
column          4  109.4  27.358
P:column        4  208.0  51.988
R               4   90.6  22.657
P:R             4  505.0 126.238
```

```
column:R       16 3357.8 209.864
P:column:R     16 1442.6  90.163
S               3   16.4   5.458
P:S             3   14.3   4.765
column:S       12  265.4  22.121
P:column:S     12   96.5   8.044
R:S            12  195.0  16.254
column:R:S     48  365.5   7.615
P:R:S          12  100.3   8.361
P:column:R:S   48  514.7  10.723


$Parameter
              Estimate Std. Error t value Pr(>|t|)
(Intercept)         98
P1                  -2
P2                   0
column1            -10
column2            -20
column3              0
column4            -13
column5              0
P1:column1          12
P1:column2          12
P1:column3           1
P1:column4          13
P1:column5           0
P2:column1           0
P2:column2           0
P2:column3           0
P2:column4           0
P2:column5           0
R1                  -9
R2                   1
R3                 -15
R4                  -1
R5                   0
P1:R1               12
P1:R2                2
P1:R3               -3
P1:R4                3
P1:R5                0
P2:R1                0
P2:R2                0
P2:R3                0
P2:R4                0
P2:R5                0
column1:R1          19
column1:R2          10
```

```
column1:R3              28
column1:R4               1
column1:R5               0
column2:R1              21
column2:R2               7
column2:R3              33
column2:R4              20
column2:R5               0
column3:R1               7
column3:R2              -6
column3:R3              12
column3:R4              -5
column3:R5               0
column4:R1              23
column4:R2               1
column4:R3              13
column4:R4              14
column4:R5               0
column5:R1               0
column5:R2               0
column5:R3               0
column5:R4               0
column5:R5               0
P1:column1:R1          -40
P1:column1:R2          -12
P1:column1:R3           -5
P1:column1:R4           -2
P1:column1:R5            0
P1:column2:R1          -23
P1:column2:R2           -8
P1:column2:R3          -10
P1:column2:R4          -11
P1:column2:R5            0
P1:column3:R1           -9
P1:column3:R2            1
P1:column3:R3            8
P1:column3:R4           -6
P1:column3:R5            0
P1:column4:R1          -34
P1:column4:R2            0
P1:column4:R3            8
P1:column4:R4          -18
P1:column4:R5            0
P1:column5:R1            0
P1:column5:R2            0
P1:column5:R3            0
P1:column5:R4            0
P1:column5:R5            0
```

```
P2:column1:R1          0
P2:column1:R2          0
P2:column1:R3          0
P2:column1:R4          0
P2:column1:R5          0
P2:column2:R1          0
P2:column2:R2          0
P2:column2:R3          0
P2:column2:R4          0
P2:column2:R5          0
P2:column3:R1          0
P2:column3:R2          0
P2:column3:R3          0
P2:column3:R4          0
P2:column3:R5          0
P2:column4:R1          0
P2:column4:R2          0
P2:column4:R3          0
P2:column4:R4          0
P2:column4:R5          0
P2:column5:R1          0
P2:column5:R2          0
P2:column5:R3          0
P2:column5:R4          0
P2:column5:R5          0
S1                     1
S2                    -2
S3                    -5
S4                     0
P1:S1                  1
P1:S2                 -1
P1:S3                  7
P1:S4                  0
P2:S1                  0
P2:S2                  0
P2:S3                  0
P2:S4                  0
column1:S1             9
column1:S2             1
column1:S3            16
column1:S4             0
column2:S1            -2
column2:S2             4
column2:S3             6
column2:S4             0
column3:S1            -3
column3:S2            -8
column3:S3             5
```

```
column3:S4              0
column4:S1              2
column4:S2              6
column4:S3              7
column4:S4              0
column5:S1              0
column5:S2              0
column5:S3              0
column5:S4              0
P1:column1:S1         -12
P1:column1:S2           2
P1:column1:S3         -17
P1:column1:S4           0
P1:column2:S1           4
P1:column2:S2           9
P1:column2:S3           3
P1:column2:S4           0
P1:column3:S1           3
P1:column3:S2          14
P1:column3:S3          -5
P1:column3:S4           0
P1:column4:S1          -5
P1:column4:S2          -4
P1:column4:S3         -10
P1:column4:S4           0
P1:column5:S1           0
P1:column5:S2           0
P1:column5:S3           0
P1:column5:S4           0
P2:column1:S1           0
P2:column1:S2           0
P2:column1:S3           0
P2:column1:S4           0
P2:column2:S1           0
P2:column2:S2           0
P2:column2:S3           0
P2:column2:S4           0
P2:column3:S1           0
P2:column3:S2           0
P2:column3:S3           0
P2:column3:S4           0
P2:column4:S1           0
P2:column4:S2           0
P2:column4:S3           0
P2:column4:S4           0
P2:column5:S1           0
P2:column5:S2           0
P2:column5:S3           0
```

```
P2:column5:S4           0
R1:S1                   8
R1:S2                  11
R1:S3                  15
R1:S4                   0
R2:S1                  -1
R2:S2                  -1
R2:S3                   4
R2:S4                   0
R3:S1                  -4
R3:S2                   0
R3:S3                   4
R3:S4                   0
R4:S1                  -8
R4:S2                  -5
R4:S3                  -2
R4:S4                   0
R5:S1                   0
R5:S2                   0
R5:S3                   0
R5:S4                   0
column1:R1:S1         -17
column1:R1:S2          -9
column1:R1:S3         -27
column1:R1:S4           0
column1:R2:S1         -14
column1:R2:S2          -8
column1:R2:S3         -16
column1:R2:S4           0
column1:R3:S1          -7
column1:R3:S2           1
column1:R3:S3         -17
column1:R3:S4           0
column1:R4:S1         -10
column1:R4:S2           3
column1:R4:S3         -19
column1:R4:S4           0
column1:R5:S1           0
column1:R5:S2           0
column1:R5:S3           0
column1:R5:S4           0
column2:R1:S1           2
column2:R1:S2          -4
column2:R1:S3         -11
column2:R1:S4           0
column2:R2:S1           4
column2:R2:S2           1
column2:R2:S3          -4
```

```
column2:R2:S4             0
column2:R3:S1             6
column2:R3:S2             0
column2:R3:S3           -10
column2:R3:S4             0
column2:R4:S1            11
column2:R4:S2             3
column2:R4:S3           -11
column2:R4:S4             0
column2:R5:S1             0
column2:R5:S2             0
column2:R5:S3             0
column2:R5:S4             0
column3:R1:S1            -5
column3:R1:S2             1
column3:R1:S3           -17
column3:R1:S4             0
column3:R2:S1             1
column3:R2:S2            10
column3:R2:S3            -7
column3:R2:S4             0
column3:R3:S1             8
column3:R3:S2            11
column3:R3:S3             0
column3:R3:S4             0
column3:R4:S1            17
column3:R4:S2            22
column3:R4:S3             8
column3:R4:S4             0
column3:R5:S1             0
column3:R5:S2             0
column3:R5:S3             0
column3:R5:S4             0
column4:R1:S1           -13
column4:R1:S2           -15
column4:R1:S3           -18
column4:R1:S4             0
column4:R2:S1             1
column4:R2:S2             5
column4:R2:S3             6
column4:R2:S4             0
column4:R3:S1             4
column4:R3:S2             1
column4:R3:S3            -2
column4:R3:S4             0
column4:R4:S1            -4
column4:R4:S2             2
column4:R4:S3            -1
```

```
column4:R4:S4            0
column4:R5:S1            0
column4:R5:S2            0
column4:R5:S3            0
column4:R5:S4            0
column5:R1:S1            0
column5:R1:S2            0
column5:R1:S3            0
column5:R1:S4            0
column5:R2:S1            0
column5:R2:S2            0
column5:R2:S3            0
column5:R2:S4            0
column5:R3:S1            0
column5:R3:S2            0
column5:R3:S3            0
column5:R3:S4            0
column5:R4:S1            0
column5:R4:S2            0
column5:R4:S3            0
column5:R4:S4            0
column5:R5:S1            0
column5:R5:S2            0
column5:R5:S3            0
column5:R5:S4            0
P1:R1:S1               -7
P1:R1:S2                0
P1:R1:S3              -18
P1:R1:S4                0
P1:R2:S1               -2
P1:R2:S2                3
P1:R2:S3              -10
P1:R2:S4                0
P1:R3:S1               12
P1:R3:S2               10
P1:R3:S3               -6
P1:R3:S4                0
P1:R4:S1                7
P1:R4:S2                5
P1:R4:S3                0
P1:R4:S4                0
P1:R5:S1                0
P1:R5:S2                0
P1:R5:S3                0
P1:R5:S4                0
P2:R1:S1                0
P2:R1:S2                0
P2:R1:S3                0
```

```
P2:R1:S4                  0
P2:R2:S1                  0
P2:R2:S2                  0
P2:R2:S3                  0
P2:R2:S4                  0
P2:R3:S1                  0
P2:R3:S2                  0
P2:R3:S3                  0
P2:R3:S4                  0
P2:R4:S1                  0
P2:R4:S2                  0
P2:R4:S3                  0
P2:R4:S4                  0
P2:R5:S1                  0
P2:R5:S2                  0
P2:R5:S3                  0
P2:R5:S4                  0
P1:column1:R1:S1         17
P1:column1:R1:S2         -1
P1:column1:R1:S3         33
P1:column1:R1:S4          0
P1:column1:R2:S1         14
P1:column1:R2:S2          4
P1:column1:R2:S3         20
P1:column1:R2:S4          0
P1:column1:R3:S1         -2
P1:column1:R3:S2        -16
P1:column1:R3:S3         16
P1:column1:R3:S4          0
P1:column1:R4:S1          9
P1:column1:R4:S2        -14
P1:column1:R4:S3         19
P1:column1:R4:S4          0
P1:column1:R5:S1          0
P1:column1:R5:S2          0
P1:column1:R5:S3          0
P1:column1:R5:S4          0
P1:column2:R1:S1          2
P1:column2:R1:S2         -8
P1:column2:R1:S3         11
P1:column2:R1:S4          0
P1:column2:R2:S1         -5
P1:column2:R2:S2        -13
P1:column2:R2:S3         -1
P1:column2:R2:S4          0
P1:column2:R3:S1        -15
P1:column2:R3:S2        -14
P1:column2:R3:S3          6
```

```
P1:column2:R3:S4          0
P1:column2:R4:S1        -13
P1:column2:R4:S2        -12
P1:column2:R4:S3          1
P1:column2:R4:S4          0
P1:column2:R5:S1          0
P1:column2:R5:S2          0
P1:column2:R5:S3          0
P1:column2:R5:S4          0
P1:column3:R1:S1          3
P1:column3:R1:S2        -18
P1:column3:R1:S3         17
P1:column3:R1:S4          0
P1:column3:R2:S1        -10
P1:column3:R2:S2        -22
P1:column3:R2:S3         14
P1:column3:R2:S4          0
P1:column3:R3:S1        -19
P1:column3:R3:S2        -26
P1:column3:R3:S3          0
P1:column3:R3:S4          0
P1:column3:R4:S1        -19
P1:column3:R4:S2        -25
P1:column3:R4:S3         -8
P1:column3:R4:S4          0
P1:column3:R5:S1          0
P1:column3:R5:S2          0
P1:column3:R5:S3          0
P1:column3:R5:S4          0
P1:column4:R1:S1         12
P1:column4:R1:S2         14
P1:column4:R1:S3         30
P1:column4:R1:S4          0
P1:column4:R2:S1          5
P1:column4:R2:S2         -7
P1:column4:R2:S3          0
P1:column4:R2:S4          0
P1:column4:R3:S1        -15
P1:column4:R3:S2        -11
P1:column4:R3:S3          3
P1:column4:R3:S4          0
P1:column4:R4:S1          7
P1:column4:R4:S2          2
P1:column4:R4:S3          9
P1:column4:R4:S4          0
P1:column4:R5:S1          0
P1:column4:R5:S2          0
P1:column4:R5:S3          0
```

```
P1:column4:R5:S4        0
P1:column5:R1:S1        0
P1:column5:R1:S2        0
P1:column5:R1:S3        0
P1:column5:R1:S4        0
P1:column5:R2:S1        0
P1:column5:R2:S2        0
P1:column5:R2:S3        0
P1:column5:R2:S4        0
P1:column5:R3:S1        0
P1:column5:R3:S2        0
P1:column5:R3:S3        0
P1:column5:R3:S4        0
P1:column5:R4:S1        0
P1:column5:R4:S2        0
P1:column5:R4:S3        0
P1:column5:R4:S4        0
P1:column5:R5:S1        0
P1:column5:R5:S2        0
P1:column5:R5:S3        0
P1:column5:R5:S4        0
P2:column1:R1:S1        0
P2:column1:R1:S2        0
P2:column1:R1:S3        0
P2:column1:R1:S4        0
P2:column1:R2:S1        0
P2:column1:R2:S2        0
P2:column1:R2:S3        0
P2:column1:R2:S4        0
P2:column1:R3:S1        0
P2:column1:R3:S2        0
P2:column1:R3:S3        0
P2:column1:R3:S4        0
P2:column1:R4:S1        0
P2:column1:R4:S2        0
P2:column1:R4:S3        0
P2:column1:R4:S4        0
P2:column1:R5:S1        0
P2:column1:R5:S2        0
P2:column1:R5:S3        0
P2:column1:R5:S4        0
P2:column2:R1:S1        0
P2:column2:R1:S2        0
P2:column2:R1:S3        0
P2:column2:R1:S4        0
P2:column2:R2:S1        0
P2:column2:R2:S2        0
P2:column2:R2:S3        0
```

```
P2:column2:R2:S4        0
P2:column2:R3:S1        0
P2:column2:R3:S2        0
P2:column2:R3:S3        0
P2:column2:R3:S4        0
P2:column2:R4:S1        0
P2:column2:R4:S2        0
P2:column2:R4:S3        0
P2:column2:R4:S4        0
P2:column2:R5:S1        0
P2:column2:R5:S2        0
P2:column2:R5:S3        0
P2:column2:R5:S4        0
P2:column3:R1:S1        0
P2:column3:R1:S2        0
P2:column3:R1:S3        0
P2:column3:R1:S4        0
P2:column3:R2:S1        0
P2:column3:R2:S2        0
P2:column3:R2:S3        0
P2:column3:R2:S4        0
P2:column3:R3:S1        0
P2:column3:R3:S2        0
P2:column3:R3:S3        0
P2:column3:R3:S4        0
P2:column3:R4:S1        0
P2:column3:R4:S2        0
P2:column3:R4:S3        0
P2:column3:R4:S4        0
P2:column3:R5:S1        0
P2:column3:R5:S2        0
P2:column3:R5:S3        0
P2:column3:R5:S4        0
P2:column4:R1:S1        0
P2:column4:R1:S2        0
P2:column4:R1:S3        0
P2:column4:R1:S4        0
P2:column4:R2:S1        0
P2:column4:R2:S2        0
P2:column4:R2:S3        0
P2:column4:R2:S4        0
P2:column4:R3:S1        0
P2:column4:R3:S2        0
P2:column4:R3:S3        0
P2:column4:R3:S4        0
P2:column4:R4:S1        0
P2:column4:R4:S2        0
P2:column4:R4:S3        0
```

```
P2:column4:R4:S4        0
P2:column4:R5:S1        0
P2:column4:R5:S2        0
P2:column4:R5:S3        0
P2:column4:R5:S4        0
P2:column5:R1:S1        0
P2:column5:R1:S2        0
P2:column5:R1:S3        0
P2:column5:R1:S4        0
P2:column5:R2:S1        0
P2:column5:R2:S2        0
P2:column5:R2:S3        0
P2:column5:R2:S4        0
P2:column5:R3:S1        0
P2:column5:R3:S2        0
P2:column5:R3:S3        0
P2:column5:R3:S4        0
P2:column5:R4:S1        0
P2:column5:R4:S2        0
P2:column5:R4:S3        0
P2:column5:R4:S4        0
P2:column5:R5:S1        0
P2:column5:R5:S2        0
P2:column5:R5:S3        0
P2:column5:R5:S4        0
```

(76) MODEL

```
GLM(height ~ row + R + P + S + S:R + row:P + R:P + row:R:P + S:P + S:P:row +
    S:R:P + R:S:P:row, ex3.1a)
```

```
$ANOVA
Response : height
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL          199 7534.8  37.863
RESIDUALS        0    0.0
CORRECTED TOTAL 199 7534.8


$`Type I`
        Df  Sum Sq Mean Sq F value Pr(>F)
row      4 2017.03  504.26
R        4   90.63   22.66
P        1  253.12  253.12
S        3   16.38    5.46
R:S     12  195.05   16.25
row:P    4  167.25   41.81
R:P      4  504.95  126.24
```

```
row:R:P    32 2933.52   91.67
P:S         3   14.29    4.76
row:P:S    24  234.68    9.78
R:P:S      12  100.33    8.36
row:R:P:S  96 1007.52   10.49


$`Type II`
          Df  Sum Sq Mean Sq F value Pr(>F)
row        4 2017.03  504.26
R          4   90.63   22.66
P          1  253.12  253.12
S          3   16.38    5.46
R:S       12  195.05   16.25
row:P      4  167.25   41.81
R:P        4  504.95  126.24
row:R:P   32 2933.52   91.67
P:S        3   14.29    4.76
row:P:S   24  234.68    9.78
R:P:S     12  100.33    8.36
row:R:P:S 96 1007.52   10.49


$`Type III`
          Df  Sum Sq Mean Sq F value Pr(>F)
row        4 2017.03  504.26
R          4   90.63   22.66
P          1  253.12  253.12
S          3   16.38    5.46
R:S       12  195.05   16.25
row:P      4  167.25   41.81
R:P        4  504.95  126.24
row:R:P   32 2933.52   91.67
P:S        3   14.30    4.77
row:P:S   24  234.68    9.78
R:P:S     12  100.33    8.36
row:R:P:S 96 1007.52   10.50


$Parameter
             Estimate Std. Error t value Pr(>|t|)
(Intercept)        88
row1               10
row2               10
row3              -10
row4               -3
row5                0
R1                  2
R2                 11
R3                 -5
R4                  4
```

```
R5                    0
P1                   10
P2                    0
S1                   10
S2                   -1
S3                   11
S4                    0
R1:S1                -1
R1:S2                10
R1:S3                -6
R1:S4                 0
R2:S1               -10
R2:S2                -2
R2:S3               -12
R2:S4                 0
R3:S1                -7
R3:S2                 6
R3:S3                -7
R3:S4                 0
R4:S1                -3
R4:S2                 8
R4:S3                -5
R4:S4                 0
R5:S1                 0
R5:S2                 0
R5:S3                 0
R5:S4                 0
row1:P1             -11
row1:P2               0
row2:P1             -12
row2:P2               0
row3:P1               0
row3:P2               0
row4:P1               1
row4:P2               0
row5:P1               0
row5:P2               0
R1:P1               -11
R1:P2                 0
R2:P1               -10
R2:P2                 0
R3:P1                 6
R3:P2                 0
R4:P1               -14
R4:P2                 0
R5:P1                 0
R5:P2                 0
row1:R1:P1           11
```

```
row1:R1:P2        -11
row1:R2:P1          2
row1:R2:P2        -22
row1:R3:P1          5
row1:R3:P2          8
row1:R4:P1         12
row1:R4:P2         -5
row1:R5:P1          0
row1:R5:P2          0
row2:R1:P1         11
row2:R1:P2         -4
row2:R2:P1          2
row2:R2:P2        -10
row2:R3:P1         -4
row2:R3:P2          3
row2:R4:P1          8
row2:R4:P2         -4
row2:R5:P1          0
row2:R5:P2          0
row3:R1:P1          9
row3:R1:P2         19
row3:R2:P1          6
row3:R2:P2          4
row3:R3:P1        -11
row3:R3:P2         10
row3:R4:P1         21
row3:R4:P2          6
row3:R5:P1          0
row3:R5:P2          0
row4:R1:P1         -7
row4:R1:P2         11
row4:R2:P1         -7
row4:R2:P2        -10
row4:R3:P1          2
row4:R3:P2         15
row4:R4:P1         12
row4:R4:P2          8
row4:R5:P1          0
row4:R5:P2          0
row5:R1:P1          0
row5:R1:P2          0
row5:R2:P1          0
row5:R2:P2          0
row5:R3:P1          0
row5:R3:P2          0
row5:R4:P1          0
row5:R4:P2          0
row5:R5:P1          0
```

```
row5:R5:P2          0
P1:S1             -11
P1:S2               1
P1:S3             -10
P1:S4               0
P2:S1               0
P2:S2               0
P2:S3               0
P2:S4               0
row1:P1:S1          3
row1:P1:S2          3
row1:P1:S3          1
row1:P1:S4          0
row1:P2:S1        -12
row1:P2:S2         -9
row1:P2:S3        -11
row1:P2:S4          0
row2:P1:S1          3
row2:P1:S2         -3
row2:P1:S3          1
row2:P1:S4          0
row2:P2:S1         -9
row2:P2:S2         -1
row2:P2:S3        -16
row2:P2:S4          0
row3:P1:S1          5
row3:P1:S2         10
row3:P1:S3         10
row3:P1:S4          0
row3:P2:S1        -11
row3:P2:S2          3
row3:P2:S3        -10
row3:P2:S4          0
row4:P1:S1          0
row4:P1:S2         -1
row4:P1:S3         -2
row4:P1:S4          0
row4:P2:S1         -7
row4:P2:S2          5
row4:P2:S3         -9
row4:P2:S4          0
row5:P1:S1          0
row5:P1:S2          0
row5:P1:S3          0
row5:P1:S4          0
row5:P2:S1          0
row5:P2:S2          0
row5:P2:S3          0
```

```
row5:P2:S4          0
R1:P1:S1           11
R1:P1:S2           -1
R1:P1:S3           13
R1:P1:S4            0
R1:P2:S1            0
R1:P2:S2            0
R1:P2:S3            0
R1:P2:S4            0
R2:P1:S1           10
R2:P1:S2            1
R2:P1:S3            7
R2:P1:S4            0
R2:P2:S1            0
R2:P2:S2            0
R2:P2:S3            0
R2:P2:S4            0
R3:P1:S1            4
R3:P1:S2           -7
R3:P1:S3            4
R3:P1:S4            0
R3:P2:S1            0
R3:P2:S2            0
R3:P2:S3            0
R3:P2:S4            0
R4:P1:S1            3
R4:P1:S2           -8
R4:P1:S3            4
R4:P1:S4            0
R4:P2:S1            0
R4:P2:S2            0
R4:P2:S3            0
R4:P2:S4            0
R5:P1:S1            0
R5:P1:S2            0
R5:P1:S3            0
R5:P1:S4            0
R5:P2:S1            0
R5:P2:S2            0
R5:P2:S3            0
R5:P2:S4            0
row1:R1:P1:S1      -9
row1:R1:P1:S2      -4
row1:R1:P1:S3     -10
row1:R1:P1:S4       0
row1:R1:P2:S1      12
row1:R1:P2:S2       9
row1:R1:P2:S3      16
```

```
row1:R1:P2:S4          0
row1:R2:P1:S1          0
row1:R2:P1:S2         -3
row1:R2:P1:S3          2
row1:R2:P1:S4          0
row1:R2:P2:S1         15
row1:R2:P2:S2         20
row1:R2:P2:S3         24
row1:R2:P2:S4          0
row1:R3:P1:S1         -1
row1:R3:P1:S2         -7
row1:R3:P1:S3         -1
row1:R3:P1:S4          0
row1:R3:P2:S1          8
row1:R3:P2:S2          4
row1:R3:P2:S3          5
row1:R3:P2:S4          0
row1:R4:P1:S1         -1
row1:R4:P1:S2         -2
row1:R4:P1:S3         -2
row1:R4:P1:S4          0
row1:R4:P2:S1          7
row1:R4:P2:S2          2
row1:R4:P2:S3         -7
row1:R4:P2:S4          0
row1:R5:P1:S1          0
row1:R5:P1:S2          0
row1:R5:P1:S3          0
row1:R5:P1:S4          0
row1:R5:P2:S1          0
row1:R5:P2:S2          0
row1:R5:P2:S3          0
row1:R5:P2:S4          0
row2:R1:P1:S1        -11
row2:R1:P1:S2         -9
row2:R1:P1:S3        -10
row2:R1:P1:S4          0
row2:R1:P2:S1          1
row2:R1:P2:S2         -6
row2:R1:P2:S3          9
row2:R1:P2:S4          0
row2:R2:P1:S1         -6
row2:R2:P1:S2          2
row2:R2:P1:S3          2
row2:R2:P1:S4          0
row2:R2:P2:S1          4
row2:R2:P2:S2         -6
row2:R2:P2:S3         16
```

```
row2:R2:P2:S4          0
row2:R3:P1:S1          4
row2:R3:P1:S2         10
row2:R3:P1:S3          6
row2:R3:P1:S4          0
row2:R3:P2:S1          7
row2:R3:P2:S2         -2
row2:R3:P2:S3          7
row2:R3:P2:S4          0
row2:R4:P1:S1         -1
row2:R4:P1:S2          6
row2:R4:P1:S3          4
row2:R4:P1:S4          0
row2:R4:P2:S1         -7
row2:R4:P2:S2         -5
row2:R4:P2:S3          9
row2:R4:P2:S4          0
row2:R5:P1:S1          0
row2:R5:P1:S2          0
row2:R5:P1:S3          0
row2:R5:P1:S4          0
row2:R5:P2:S1          0
row2:R5:P2:S2          0
row2:R5:P2:S3          0
row2:R5:P2:S4          0
row3:R1:P1:S1        -15
row3:R1:P1:S2        -10
row3:R1:P1:S3        -10
row3:R1:P1:S4          0
row3:R1:P2:S1          0
row3:R1:P2:S2        -12
row3:R1:P2:S3          4
row3:R1:P2:S4          0
row3:R2:P1:S1        -14
row3:R2:P1:S2        -16
row3:R2:P1:S3         -3
row3:R2:P1:S4          0
row3:R2:P2:S1          9
row3:R2:P2:S2         -1
row3:R2:P2:S3          8
row3:R2:P2:S4          0
row3:R3:P1:S1          9
row3:R3:P1:S2         -2
row3:R3:P1:S3         -8
row3:R3:P1:S4          0
row3:R3:P2:S1          5
row3:R3:P2:S2        -10
row3:R3:P2:S3          5
```

```
row3:R3:P2:S4         0
row3:R4:P1:S1        -7
row3:R4:P1:S2       -21
row3:R4:P1:S3       -11
row3:R4:P1:S4         0
row3:R4:P2:S1        -4
row3:R4:P2:S2       -13
row3:R4:P2:S3        -6
row3:R4:P2:S4         0
row3:R5:P1:S1         0
row3:R5:P1:S2         0
row3:R5:P1:S3         0
row3:R5:P1:S4         0
row3:R5:P2:S1         0
row3:R5:P2:S2         0
row3:R5:P2:S3         0
row3:R5:P2:S4         0
row4:R1:P1:S1        -9
row4:R1:P1:S2        -7
row4:R1:P1:S3        -2
row4:R1:P1:S4         0
row4:R1:P2:S1        -1
row4:R1:P2:S2       -13
row4:R1:P2:S3         3
row4:R1:P2:S4         0
row4:R2:P1:S1         1
row4:R2:P1:S2         2
row4:R2:P1:S3         6
row4:R2:P1:S4         0
row4:R2:P2:S1         9
row4:R2:P2:S2         0
row4:R2:P2:S3        11
row4:R2:P2:S4         0
row4:R3:P1:S1         3
row4:R3:P1:S2         0
row4:R3:P1:S3         4
row4:R3:P1:S4         0
row4:R3:P2:S1         6
row4:R3:P2:S2        -9
row4:R3:P2:S3         9
row4:R3:P2:S4         0
row4:R4:P1:S1         2
row4:R4:P1:S2        -2
row4:R4:P1:S3         2
row4:R4:P1:S4         0
row4:R4:P2:S1        -7
row4:R4:P2:S2       -19
row4:R4:P2:S3        -4
```

```
row4:R4:P2:S4        0
row4:R5:P1:S1        0
row4:R5:P1:S2        0
row4:R5:P1:S3        0
row4:R5:P1:S4        0
row4:R5:P2:S1        0
row4:R5:P2:S2        0
row4:R5:P2:S3        0
row4:R5:P2:S4        0
row5:R1:P1:S1        0
row5:R1:P1:S2        0
row5:R1:P1:S3        0
row5:R1:P1:S4        0
row5:R1:P2:S1        0
row5:R1:P2:S2        0
row5:R1:P2:S3        0
row5:R1:P2:S4        0
row5:R2:P1:S1        0
row5:R2:P1:S2        0
row5:R2:P1:S3        0
row5:R2:P1:S4        0
row5:R2:P2:S1        0
row5:R2:P2:S2        0
row5:R2:P2:S3        0
row5:R2:P2:S4        0
row5:R3:P1:S1        0
row5:R3:P1:S2        0
row5:R3:P1:S3        0
row5:R3:P1:S4        0
row5:R3:P2:S1        0
row5:R3:P2:S2        0
row5:R3:P2:S3        0
row5:R3:P2:S4        0
row5:R4:P1:S1        0
row5:R4:P1:S2        0
row5:R4:P1:S3        0
row5:R4:P1:S4        0
row5:R4:P2:S1        0
row5:R4:P2:S2        0
row5:R4:P2:S3        0
row5:R4:P2:S4        0
row5:R5:P1:S1        0
row5:R5:P1:S2        0
row5:R5:P1:S3        0
row5:R5:P1:S4        0
row5:R5:P2:S1        0
row5:R5:P2:S2        0
row5:R5:P2:S3        0
```

```
row5:R5:P2:S4         0
```

```r
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(height ~ row + R + P + S + S:R + row:P + R:P + row:R:P + S:P +
         S:P:row + S:R:P + R:S:P:row, ex3.1a), type=3, singular.ok=TRUE)
         # NOT WORKING
```

```r
alias(height ~ row + R + P + S + S:R + row:P + R:P + row:R:P + S:P + S:P:row +
    S:R:P + R:S:P:row, ex3.1a) # NO ALIAS
```

```
Model :
height ~ row + R + P + S + S:R + row:P + R:P + row:R:P + S:P +
    S:P:row + S:R:P + R:S:P:row
```

 (77) MODEL

- p94 Appendix 3.1

```r
ex3.1b = read.table("C:/G/Rt/Split/spexvar3.txt", header=TRUE)
ex3.1b = af(ex3.1b, c("rep", "var", "nit", "row", "col"))
GLM(yield ~ rep + var + rep:var + nit + var:nit, ex3.1b)
```

```
$ANOVA
Response : yield
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           26  44017 1692.97  9.5603 4.779e-11 ***
RESIDUALS       45   7969  177.08
CORRECTED TOTAL 71  51986
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
        Df  Sum Sq Mean Sq F value    Pr(>F)
rep      5 15875.3  3175.1 17.9297 9.525e-10 ***
var      2  1786.4   893.2  5.0438  0.010557 *
rep:var 10  6013.3   601.3  3.3957  0.002251 **
nit      3 20020.5  6673.5 37.6856 2.458e-12 ***
var:nit  6   321.7    53.6  0.3028  0.932199
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
        Df  Sum Sq Mean Sq F value    Pr(>F)
rep      5 15875.3  3175.1 17.9297 9.525e-10 ***
var      2  1786.4   893.2  5.0438  0.010557 *
```

```
rep:var 10   6013.3    601.3   3.3957  0.002251 **
nit      3 20020.5   6673.5 37.6856 2.458e-12 ***
var:nit  6    321.7     53.6  0.3028  0.932199
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
        Df  Sum Sq Mean Sq F value    Pr(>F)
rep      5 15875.3  3175.1 17.9297 9.525e-10 ***
var      2  1786.4   893.2  5.0438  0.010557 *
rep:var 10  6013.3   601.3  3.3957  0.002251 **
nit      3 20020.5  6673.5 37.6856 2.458e-12 ***
var:nit  6   321.7    53.6  0.3028  0.932199
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   85.875     8.1490 10.5381 9.814e-14 ***
rep1          20.750     9.4097  2.2052 0.0325933 *
rep2         -14.000     9.4097 -1.4878 0.1437694
rep3          12.250     9.4097  1.3019 0.1995913
rep4         -23.750     9.4097 -2.5240 0.0152008 *
rep5           9.500     9.4097  1.0096 0.3180846
rep6           0.000     0.0000
var1         -22.500    11.5244 -1.9524 0.0571318 .
var2         -20.125    11.5244 -1.7463 0.0875843 .
var3           0.000     0.0000
rep1:var1     32.750    13.3073  2.4611 0.0177533 *
rep1:var2     22.250    13.3073  1.6720 0.1014609
rep1:var3      0.000     0.0000
rep2:var1     16.000    13.3073  1.2024 0.2355164
rep2:var2     31.750    13.3073  2.3859 0.0213053 *
rep2:var3      0.000     0.0000
rep3:var1    -14.500    13.3073 -1.0896 0.2816769
rep3:var2     10.750    13.3073  0.8078 0.4234387
rep3:var3      0.000     0.0000
rep4:var1     26.250    13.3073  1.9726 0.0547034 .
rep4:var2     29.000    13.3073  2.1793 0.0345870 *
rep4:var3      0.000     0.0000
rep5:var1    -16.500    13.3073 -1.2399 0.2214304
rep5:var2    -13.000    13.3073 -0.9769 0.3338365
rep5:var3      0.000     0.0000
rep6:var1      0.000     0.0000
rep6:var2      0.000     0.0000
rep6:var3      0.000     0.0000
nit1          21.833     7.6830  2.8418 0.0067187 **
nit2          30.500     7.6830  3.9698 0.0002562 ***
```

```
nit3              40.167       7.6830   5.2280 4.290e-06 ***
nit4               0.000       0.0000
var1:nit1         -3.667      10.8653  -0.3375 0.7373358
var1:nit2          8.833      10.8653   0.8130 0.4205085
var1:nit3          6.833      10.8653   0.6289 0.5325868
var1:nit4          0.000       0.0000
var2:nit1         -3.333      10.8653  -0.3068 0.7604214
var2:nit2          4.167      10.8653   0.3835 0.7031679
var2:nit3          4.667      10.8653   0.4295 0.6696087
var2:nit4          0.000       0.0000
var3:nit1          0.000       0.0000
var3:nit2          0.000       0.0000
var3:nit3          0.000       0.0000
var3:nit4          0.000       0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(78) MODEL

```
GLM(yield ~ rep + var + rep:var + nit + var:nit + row + col, ex3.1b)
```

```
$ANOVA
Response : yield
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           37  48090  1299.7  11.341 6.734e-11 ***
RESIDUALS       34   3896   114.6
CORRECTED TOTAL 71  51986
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
        Df  Sum Sq Mean Sq F value     Pr(>F)
rep      5 15875.3  3175.1 27.7056 4.391e-11 ***
var      2  1786.4   893.2  7.7939 0.0016359 **
rep:var 10  6013.3   601.3  5.2472 0.0001207 ***
nit      3 20020.5  6673.5 58.2331 1.754e-13 ***
var:nit  6   321.7    53.6  0.4679 0.8271333
row      9   900.9   100.1  0.8734 0.5575581
col      2  3171.5  1585.7 13.8373 4.012e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
        Df  Sum Sq Mean Sq F value     Pr(>F)
rep      2  5942.5  2971.3 25.9273 1.449e-07 ***
var      2  2799.8  1399.9 12.2155 0.0001005 ***
rep:var  4   997.8   249.4  2.1767 0.0926008 .
```

```
nit       3 12559.3  4186.4 36.5308 9.683e-11 ***
var:nit   6   477.8    79.6  0.6949 0.6553307
row       9   945.0   105.0  0.9162 0.5230151
col       2  3171.5  1585.7 13.8373 4.012e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
CAUTION: Singularity Exists !
         Df  Sum Sq Mean Sq F value    Pr(>F)
rep       2  5942.5  2971.3 25.9273 1.449e-07 ***
var       2  2799.8  1399.9 12.2155 0.0001005 ***
rep:var   4   997.8   249.4  2.1767 0.0926008 .
nit       3 11977.9  3992.6 34.8397 1.775e-10 ***
var:nit   6   477.8    79.6  0.6949 0.6553307
row       9   945.0   105.0  0.9162 0.5230151
col       2  3171.5  1585.7 13.8373 4.012e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   78.195     9.4953  8.2351 1.311e-09 ***
rep1          22.320    11.2116  1.9908 0.0545890 .
rep2          -9.827     9.9492 -0.9877 0.3302882
rep3          16.942    10.2780  1.6484 0.1084805
rep4         -24.656    10.6082 -2.3242 0.0262249 *
rep5          16.807    10.1264  1.6597 0.1061670
rep6           0.000     0.0000
var1         -23.629    12.0789 -1.9562 0.0586954 .
var2         -16.007    11.9933 -1.3346 0.1908629
var3           0.000     0.0000
rep1:var1     39.666    14.2816  2.7775 0.0088510 **
rep1:var2     24.703    14.1608  1.7445 0.0901108 .
rep1:var3      0.000     0.0000
rep2:var1     22.158    13.3805  1.6560 0.1069231
rep2:var2     35.142    13.4753  2.6079 0.0134358 *
rep2:var3      0.000     0.0000
rep3:var1    -15.615    15.0163 -1.0399 0.3057408
rep3:var2      5.214    14.8157  0.3519 0.7270537
rep3:var3      0.000     0.0000
rep4:var1     32.022    14.0835  2.2737 0.0294152 *
rep4:var2     32.597    14.2110  2.2938 0.0281056 *
rep4:var3      0.000     0.0000
rep5:var1    -15.951    13.7718 -1.1582 0.2548377
rep5:var2    -20.826    14.0023 -1.4873 0.1461435
rep5:var3      0.000     0.0000
rep6:var1      0.000     0.0000
```

```
rep6:var2        0.000      0.0000
rep6:var3        0.000      0.0000
nit1            20.904      6.8122   3.0686 0.0042045 **
nit2            25.790      7.9006   3.2643 0.0025052 **
nit3            43.888      8.4402   5.1999 9.452e-06 ***
nit4             0.000      0.0000
var1:nit1        1.136      9.7632   0.1164 0.9080219
var1:nit2       14.232     10.2550   1.3878 0.1742328
var1:nit3       -3.260     11.0914  -0.2939 0.7705879
var1:nit4        0.000      0.0000
var2:nit1       -1.428      9.1191  -0.1566 0.8764628
var2:nit2        5.784     11.0936   0.5214 0.6054692
var2:nit3       -6.461     11.3313  -0.5702 0.5722670
var2:nit4        0.000      0.0000
var3:nit1        0.000      0.0000
var3:nit2        0.000      0.0000
var3:nit3        0.000      0.0000
var3:nit4        0.000      0.0000
row1             1.613      9.9332   0.1624 0.8719639
row10          -13.706      8.4538  -1.6213 0.1141882
row11          -14.812      8.7800  -1.6870 0.1007506
row12            0.000      0.0000
row13            2.006      8.3976   0.2389 0.8126419
row14            0.000      0.0000
row15           -4.632      8.4677  -0.5470 0.5879538
row16            0.000      0.0000
row17           -0.198      8.7515  -0.0226 0.9820790
row18            0.000      0.0000
row2             0.000      0.0000
row3           -10.016      8.3602  -1.1980 0.2391928
row4             0.000      0.0000
row5            -7.727      8.5301  -0.9059 0.3713775
row6             0.000      0.0000
row7            -3.594      8.6347  -0.4162 0.6798797
row8             0.000      0.0000
row9             0.000      0.0000
col1            11.566      3.9157   2.9538 0.0056610 **
col2             0.000      0.0000
col3            16.517      4.1675   3.9633 0.0003597 ***
col4             0.000      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(yield ~ rep + var + rep:var + nit + var:nit + row + col, ex3.1b),
      type=3, singular.ok=TRUE) # NOT OK for var
```

```
Note: model has aliased coefficients
```

sums of squares computed by model comparison

Anova Table (Type III tests)

Response: yield
          Sum Sq Df F values   Pr(>F)
rep   5942.5 2 25.9273 1.449e-07 ***
var   0.0 0
nit   11977.9 3 34.8397 1.775e-10 ***
row   945.0 9   0.9162   0.5230
col   3171.5 2 13.8373 4.012e-05 ***
rep:var   997.8 4   2.1767   0.0926 .
var:nit   477.8 6   0.6949   0.6553
Residuals 3896.4 34

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

7.6   Example 4.1

(79) MODEL

```
ex4.1 = read.table("C:/G/Rt/Split/Ex4.1-example.txt", header=TRUE)
ex4.1 = af(ex4.1, c("row", "P", "column", "R", "S"))
GLM(height ~ P + column + column:P + R + P:R + column:R + column:R:P + S +
   P:S + column:S + column:S:P + R:S + R:S:column + R:S:P + R:S:P:column, ex4.1)
```


$ANOVA
Response : height
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL   199 1710.2 8.5937
RESIDUALS   0   0.0
CORRECTED TOTAL 199 1710.2

$`Type I`
            Df Sum Sq Mean Sq F value Pr(>F)
P   1 28.12 28.1250
column   4 34.33 8.5825
P:column   4 91.45 22.8625
R   4 31.03 7.7575
P:R   4 48.95 12.2375
column:R   16 467.92 29.2450
P:column:R 16 350.10 21.8813
S   3   3.77 1.2583
P:S   3   3.29 1.0983
column:S   12 74.55 6.2125
P:column:S 12 47.03 3.9192

```
R:S              12  36.65  3.0542
column:R:S       48 197.40  4.1125
P:R:S            12  26.33  2.1942
P:column:R:S     48 269.22  5.6087


$`Type II`
              Df Sum Sq Mean Sq F value Pr(>F)
P              1  28.13 28.1250
column         4  34.33  8.5825
P:column       4  91.45 22.8625
R              4  31.03  7.7575
P:R            4  48.95 12.2375
column:R      16 467.92 29.2450
P:column:R    16 350.10 21.8812
S              3   3.77  1.2583
P:S            3   3.30  1.0983
column:S      12  74.55  6.2125
P:column:S    12  47.03  3.9192
R:S           12  36.65  3.0542
column:R:S    48 197.40  4.1125
P:R:S         12  26.33  2.1942
P:column:R:S  48 269.22  5.6087


$`Type III`
              Df Sum Sq Mean Sq F value Pr(>F)
P              1  28.12 28.1250
column         4  34.33  8.5825
P:column       4  91.45 22.8625
R              4  31.03  7.7575
P:R            4  48.95 12.2375
column:R      16 467.92 29.2450
P:column:R    16 350.10 21.8813
S              3   3.77  1.2583
P:S            3   3.29  1.0983
column:S      12  74.55  6.2125
P:column:S    12  47.03  3.9192
R:S           12  36.65  3.0542
column:R:S    48 197.40  4.1125
P:R:S         12  26.33  2.1942
P:column:R:S  48 269.22  5.6088


$Parameter
              Estimate Std. Error t value Pr(>|t|)
(Intercept)          8
P1                  -2
P2                   0
column1              0
column2              0
```

```
column3                 0
column4                -3
column5                 0
P1:column1              2
P1:column2              2
P1:column3              1
P1:column4              3
P1:column5              0
P2:column1              0
P2:column2              0
P2:column3              0
P2:column4              0
P2:column5              0
R1                      1
R2                      1
R3                     -5
R4                     -1
R5                      0
P1:R1                   2
P1:R2                   2
P1:R3                   7
P1:R4                   3
P1:R5                   0
P2:R1                   0
P2:R2                   0
P2:R3                   0
P2:R4                   0
P2:R5                   0
column1:R1             -1
column1:R2              0
column1:R3              8
column1:R4              1
column1:R5              0
column2:R1             -9
column2:R2             -3
column2:R3              3
column2:R4              0
column2:R5              0
column3:R1             -3
column3:R2             -6
column3:R3              2
column3:R4             -5
column3:R5              0
column4:R1              3
column4:R2              1
column4:R3              3
column4:R4              4
column4:R5              0
```

```
column5:R1              0
column5:R2              0
column5:R3              0
column5:R4              0
column5:R5              0
P1:column1:R1         -10
P1:column1:R2          -2
P1:column1:R3          -5
P1:column1:R4          -2
P1:column1:R5           0
P1:column2:R1           7
P1:column2:R2          -8
P1:column2:R3         -10
P1:column2:R4          -1
P1:column2:R5           0
P1:column3:R1           1
P1:column3:R2           1
P1:column3:R3          -2
P1:column3:R4           4
P1:column3:R5           0
P1:column4:R1          -4
P1:column4:R2           0
P1:column4:R3          -2
P1:column4:R4          -8
P1:column4:R5           0
P1:column5:R1           0
P1:column5:R2           0
P1:column5:R3           0
P1:column5:R4           0
P1:column5:R5           0
P2:column1:R1           0
P2:column1:R2           0
P2:column1:R3           0
P2:column1:R4           0
P2:column1:R5           0
P2:column2:R1           0
P2:column2:R2           0
P2:column2:R3           0
P2:column2:R4           0
P2:column2:R5           0
P2:column3:R1           0
P2:column3:R2           0
P2:column3:R3           0
P2:column3:R4           0
P2:column3:R5           0
P2:column4:R1           0
P2:column4:R2           0
P2:column4:R3           0
```

```
P2:column4:R4          0
P2:column4:R5          0
P2:column5:R1          0
P2:column5:R2          0
P2:column5:R3          0
P2:column5:R4          0
P2:column5:R5          0
S1                     1
S2                    -2
S3                    -5
S4                     0
P1:S1                  1
P1:S2                 -1
P1:S3                  7
P1:S4                  0
P2:S1                  0
P2:S2                  0
P2:S3                  0
P2:S4                  0
column1:S1            -1
column1:S2             1
column1:S3             6
column1:S4             0
column2:S1            -2
column2:S2            -6
column2:S3             6
column2:S4             0
column3:S1            -3
column3:S2             2
column3:S3             5
column3:S4             0
column4:S1             2
column4:S2             6
column4:S3             7
column4:S4             0
column5:S1             0
column5:S2             0
column5:S3             0
column5:S4             0
P1:column1:S1         -2
P1:column1:S2          2
P1:column1:S3         -7
P1:column1:S4          0
P1:column2:S1         -6
P1:column2:S2          9
P1:column2:S3         -7
P1:column2:S4          0
P1:column3:S1          3
```

```
P1:column3:S2            4
P1:column3:S3           -5
P1:column3:S4            0
P1:column4:S1           -5
P1:column4:S2           -4
P1:column4:S3          -10
P1:column4:S4            0
P1:column5:S1            0
P1:column5:S2            0
P1:column5:S3            0
P1:column5:S4            0
P2:column1:S1            0
P2:column1:S2            0
P2:column1:S3            0
P2:column1:S4            0
P2:column2:S1            0
P2:column2:S2            0
P2:column2:S3            0
P2:column2:S4            0
P2:column3:S1            0
P2:column3:S2            0
P2:column3:S3            0
P2:column3:S4            0
P2:column4:S1            0
P2:column4:S2            0
P2:column4:S3            0
P2:column4:S4            0
P2:column5:S1            0
P2:column5:S2            0
P2:column5:S3            0
P2:column5:S4            0
R1:S1                   -2
R1:S2                    1
R1:S3                    5
R1:S4                    0
R2:S1                   -1
R2:S2                   -1
R2:S3                    4
R2:S4                    0
R3:S1                   -4
R3:S2                    0
R3:S3                    4
R3:S4                    0
R4:S1                   -8
R4:S2                   -5
R4:S3                   -2
R4:S4                    0
R5:S1                    0
```

```
R5:S2                     0
R5:S3                     0
R5:S4                     0
column1:R1:S1             3
column1:R1:S2             1
column1:R1:S3            -7
column1:R1:S4             0
column1:R2:S1            -4
column1:R2:S2             2
column1:R2:S3            -6
column1:R2:S4             0
column1:R3:S1             3
column1:R3:S2             1
column1:R3:S3            -7
column1:R3:S4             0
column1:R4:S1             0
column1:R4:S2             3
column1:R4:S3             1
column1:R4:S4             0
column1:R5:S1             0
column1:R5:S2             0
column1:R5:S3             0
column1:R5:S4             0
column2:R1:S1            12
column2:R1:S2            16
column2:R1:S3            -1
column2:R1:S4             0
column2:R2:S1             4
column2:R2:S2            11
column2:R2:S3            -4
column2:R2:S4             0
column2:R3:S1             6
column2:R3:S2            10
column2:R3:S3           -10
column2:R3:S4             0
column2:R4:S1            11
column2:R4:S2            13
column2:R4:S3            -1
column2:R4:S4             0
column2:R5:S1             0
column2:R5:S2             0
column2:R5:S3             0
column2:R5:S4             0
column3:R1:S1             5
column3:R1:S2             1
column3:R1:S3            -7
column3:R1:S4             0
column3:R2:S1             1
```

```
column3:R2:S2          0
column3:R2:S3         -7
column3:R2:S4          0
column3:R3:S1          8
column3:R3:S2          1
column3:R3:S3          0
column3:R3:S4          0
column3:R4:S1         17
column3:R4:S2         12
column3:R4:S3          8
column3:R4:S4          0
column3:R5:S1          0
column3:R5:S2          0
column3:R5:S3          0
column3:R5:S4          0
column4:R1:S1         -3
column4:R1:S2         -5
column4:R1:S3         -8
column4:R1:S4          0
column4:R2:S1         -9
column4:R2:S2         -5
column4:R2:S3         -4
column4:R2:S4          0
column4:R3:S1          4
column4:R3:S2          1
column4:R3:S3         -2
column4:R3:S4          0
column4:R4:S1          6
column4:R4:S2          2
column4:R4:S3         -1
column4:R4:S4          0
column4:R5:S1          0
column4:R5:S2          0
column4:R5:S3          0
column4:R5:S4          0
column5:R1:S1          0
column5:R1:S2          0
column5:R1:S3          0
column5:R1:S4          0
column5:R2:S1          0
column5:R2:S2          0
column5:R2:S3          0
column5:R2:S4          0
column5:R3:S1          0
column5:R3:S2          0
column5:R3:S3          0
column5:R3:S4          0
column5:R4:S1          0
```

```
column5:R4:S2          0
column5:R4:S3          0
column5:R4:S4          0
column5:R5:S1          0
column5:R5:S2          0
column5:R5:S3          0
column5:R5:S4          0
P1:R1:S1               3
P1:R1:S2              10
P1:R1:S3              -8
P1:R1:S4               0
P1:R2:S1              -2
P1:R2:S2               3
P1:R2:S3             -10
P1:R2:S4               0
P1:R3:S1               2
P1:R3:S2               0
P1:R3:S3              -6
P1:R3:S4               0
P1:R4:S1               7
P1:R4:S2               5
P1:R4:S3               0
P1:R4:S4               0
P1:R5:S1               0
P1:R5:S2               0
P1:R5:S3               0
P1:R5:S4               0
P2:R1:S1               0
P2:R1:S2               0
P2:R1:S3               0
P2:R1:S4               0
P2:R2:S1               0
P2:R2:S2               0
P2:R2:S3               0
P2:R2:S4               0
P2:R3:S1               0
P2:R3:S2               0
P2:R3:S3               0
P2:R3:S4               0
P2:R4:S1               0
P2:R4:S2               0
P2:R4:S3               0
P2:R4:S4               0
P2:R5:S1               0
P2:R5:S2               0
P2:R5:S3               0
P2:R5:S4               0
P1:column1:R1:S1      -3
```

```
P1:column1:R1:S2      -11
P1:column1:R1:S3       13
P1:column1:R1:S4        0
P1:column1:R2:S1        4
P1:column1:R2:S2       -6
P1:column1:R2:S3       10
P1:column1:R2:S4        0
P1:column1:R3:S1       -2
P1:column1:R3:S2       -6
P1:column1:R3:S3        6
P1:column1:R3:S4        0
P1:column1:R4:S1       -1
P1:column1:R4:S2       -4
P1:column1:R4:S3       -1
P1:column1:R4:S4        0
P1:column1:R5:S1        0
P1:column1:R5:S2        0
P1:column1:R5:S3        0
P1:column1:R5:S4        0
P1:column2:R1:S1       -8
P1:column2:R1:S2      -28
P1:column2:R1:S3        1
P1:column2:R1:S4        0
P1:column2:R2:S1        5
P1:column2:R2:S2      -13
P1:column2:R2:S3        9
P1:column2:R2:S4        0
P1:column2:R3:S1        5
P1:column2:R3:S2       -4
P1:column2:R3:S3       16
P1:column2:R3:S4        0
P1:column2:R4:S1       -3
P1:column2:R4:S2      -12
P1:column2:R4:S3        1
P1:column2:R4:S4        0
P1:column2:R5:S1        0
P1:column2:R5:S2        0
P1:column2:R5:S3        0
P1:column2:R5:S4        0
P1:column3:R1:S1       -7
P1:column3:R1:S2      -18
P1:column3:R1:S3        7
P1:column3:R1:S4        0
P1:column3:R2:S1        0
P1:column3:R2:S2       -2
P1:column3:R2:S3       14
P1:column3:R2:S4        0
P1:column3:R3:S1       -9
```

```
P1:column3:R3:S2        -6
P1:column3:R3:S3         0
P1:column3:R3:S4         0
P1:column3:R4:S1       -19
P1:column3:R4:S2       -15
P1:column3:R4:S3        -8
P1:column3:R4:S4         0
P1:column3:R5:S1         0
P1:column3:R5:S2         0
P1:column3:R5:S3         0
P1:column3:R5:S4         0
P1:column4:R1:S1         2
P1:column4:R1:S2        -6
P1:column4:R1:S3        10
P1:column4:R1:S4         0
P1:column4:R2:S1        15
P1:column4:R2:S2         3
P1:column4:R2:S3        10
P1:column4:R2:S4         0
P1:column4:R3:S1        -5
P1:column4:R3:S2        -1
P1:column4:R3:S3         3
P1:column4:R3:S4         0
P1:column4:R4:S1        -3
P1:column4:R4:S2         2
P1:column4:R4:S3         9
P1:column4:R4:S4         0
P1:column4:R5:S1         0
P1:column4:R5:S2         0
P1:column4:R5:S3         0
P1:column4:R5:S4         0
P1:column5:R1:S1         0
P1:column5:R1:S2         0
P1:column5:R1:S3         0
P1:column5:R1:S4         0
P1:column5:R2:S1         0
P1:column5:R2:S2         0
P1:column5:R2:S3         0
P1:column5:R2:S4         0
P1:column5:R3:S1         0
P1:column5:R3:S2         0
P1:column5:R3:S3         0
P1:column5:R3:S4         0
P1:column5:R4:S1         0
P1:column5:R4:S2         0
P1:column5:R4:S3         0
P1:column5:R4:S4         0
P1:column5:R5:S1         0
```

```
P1:column5:R5:S2         0
P1:column5:R5:S3         0
P1:column5:R5:S4         0
P2:column1:R1:S1         0
P2:column1:R1:S2         0
P2:column1:R1:S3         0
P2:column1:R1:S4         0
P2:column1:R2:S1         0
P2:column1:R2:S2         0
P2:column1:R2:S3         0
P2:column1:R2:S4         0
P2:column1:R3:S1         0
P2:column1:R3:S2         0
P2:column1:R3:S3         0
P2:column1:R3:S4         0
P2:column1:R4:S1         0
P2:column1:R4:S2         0
P2:column1:R4:S3         0
P2:column1:R4:S4         0
P2:column1:R5:S1         0
P2:column1:R5:S2         0
P2:column1:R5:S3         0
P2:column1:R5:S4         0
P2:column2:R1:S1         0
P2:column2:R1:S2         0
P2:column2:R1:S3         0
P2:column2:R1:S4         0
P2:column2:R2:S1         0
P2:column2:R2:S2         0
P2:column2:R2:S3         0
P2:column2:R2:S4         0
P2:column2:R3:S1         0
P2:column2:R3:S2         0
P2:column2:R3:S3         0
P2:column2:R3:S4         0
P2:column2:R4:S1         0
P2:column2:R4:S2         0
P2:column2:R4:S3         0
P2:column2:R4:S4         0
P2:column2:R5:S1         0
P2:column2:R5:S2         0
P2:column2:R5:S3         0
P2:column2:R5:S4         0
P2:column3:R1:S1         0
P2:column3:R1:S2         0
P2:column3:R1:S3         0
P2:column3:R1:S4         0
P2:column3:R2:S1         0
```

```
P2:column3:R2:S2        0
P2:column3:R2:S3        0
P2:column3:R2:S4        0
P2:column3:R3:S1        0
P2:column3:R3:S2        0
P2:column3:R3:S3        0
P2:column3:R3:S4        0
P2:column3:R4:S1        0
P2:column3:R4:S2        0
P2:column3:R4:S3        0
P2:column3:R4:S4        0
P2:column3:R5:S1        0
P2:column3:R5:S2        0
P2:column3:R5:S3        0
P2:column3:R5:S4        0
P2:column4:R1:S1        0
P2:column4:R1:S2        0
P2:column4:R1:S3        0
P2:column4:R1:S4        0
P2:column4:R2:S1        0
P2:column4:R2:S2        0
P2:column4:R2:S3        0
P2:column4:R2:S4        0
P2:column4:R3:S1        0
P2:column4:R3:S2        0
P2:column4:R3:S3        0
P2:column4:R3:S4        0
P2:column4:R4:S1        0
P2:column4:R4:S2        0
P2:column4:R4:S3        0
P2:column4:R4:S4        0
P2:column4:R5:S1        0
P2:column4:R5:S2        0
P2:column4:R5:S3        0
P2:column4:R5:S4        0
P2:column5:R1:S1        0
P2:column5:R1:S2        0
P2:column5:R1:S3        0
P2:column5:R1:S4        0
P2:column5:R2:S1        0
P2:column5:R2:S2        0
P2:column5:R2:S3        0
P2:column5:R2:S4        0
P2:column5:R3:S1        0
P2:column5:R3:S2        0
P2:column5:R3:S3        0
P2:column5:R3:S4        0
P2:column5:R4:S1        0
```

```
P2:column5:R4:S2        0
P2:column5:R4:S3        0
P2:column5:R4:S4        0
P2:column5:R5:S1        0
P2:column5:R5:S2        0
P2:column5:R5:S3        0
P2:column5:R5:S4        0
```

 (80) MODEL

```
GLM(height ~ row + R + P + S + S:R + row:P + R:P + row:R:P + S:P + S:P:row +
    S:R:P + R:S:P:row, ex4.1)
```

```
$ANOVA
Response : height
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL          199 1710.2  8.5937
RESIDUALS        0    0.0
CORRECTED TOTAL 199 1710.2

$`Type I`
          Df Sum Sq Mean Sq F value Pr(>F)
row        4 309.43  77.357
R          4  31.03   7.758
P          1  28.12  28.125
S          3   3.77   1.258
R:S       12  36.65   3.054
row:P      4 130.25  32.563
R:P        4  48.95  12.237
row:R:P   32 504.12  15.754
P:S        3   3.29   1.098
row:P:S   24 171.28   7.137
R:P:S     12  26.33   2.194
row:R:P:S 96 416.92   4.343

$`Type II`
          Df Sum Sq Mean Sq F value Pr(>F)
row        4 309.43  77.357
R          4  31.03   7.757
P          1  28.12  28.125
S          3   3.78   1.258
R:S       12  36.65   3.054
row:P      4 130.25  32.563
R:P        4  48.95  12.238
row:R:P   32 504.12  15.754
P:S        3   3.30   1.098
row:P:S   24 171.28   7.137
```

```
R:P:S      12  26.33   2.194
row:R:P:S 96 416.92    4.343


$`Type III`
          Df Sum Sq Mean Sq F value Pr(>F)
row        4 309.43  77.358
R          4  31.03   7.757
P          1  28.13  28.125
S          3   3.78   1.258
R:S       12  36.65   3.054
row:P      4 130.25  32.563
R:P        4  48.95  12.237
row:R:P   32 504.12  15.754
P:S        3   3.30   1.098
row:P:S   24 171.28   7.137
R:P:S     12  26.33   2.194
row:R:P:S 96 416.92   4.343


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)        8
row1               0
row2               0
row3               0
row4              -3
row5               0
R1                -8
R2                 1
R3                -5
R4                -6
R5                 0
P1                 0
P2                 0
S1                 0
S2                -1
S3                 1
S4                 0
R1:S1              9
R1:S2             10
R1:S3              4
R1:S4              0
R2:S1              0
R2:S2             -2
R2:S3             -2
R2:S4              0
R3:S1              3
R3:S2              6
R3:S3              3
```

```
R3:S4                    0
R4:S1                    7
R4:S2                    8
R4:S3                    5
R4:S4                    0
R5:S1                    0
R5:S2                    0
R5:S3                    0
R5:S4                    0
row1:P1                 -1
row1:P2                  0
row2:P1                 -2
row2:P2                  0
row3:P1                  0
row3:P2                  0
row4:P1                  1
row4:P2                  0
row5:P1                  0
row5:P2                  0
R1:P1                    9
R1:P2                    0
R2:P1                    0
R2:P2                    0
R3:P1                    6
R3:P2                    0
R4:P1                    6
R4:P2                    0
R5:P1                    0
R5:P2                    0
row1:R1:P1               1
row1:R1:P2               9
row1:R2:P1               2
row1:R2:P2              -2
row1:R3:P1               5
row1:R3:P2               8
row1:R4:P1               2
row1:R4:P2               5
row1:R5:P1               0
row1:R5:P2               0
row2:R1:P1               1
row2:R1:P2               6
row2:R2:P1               2
row2:R2:P2               0
row2:R3:P1              -4
row2:R3:P2               3
row2:R4:P1              -2
row2:R4:P2               6
row2:R5:P1               0
```

```
row2:R5:P2          0
row3:R1:P1         -1
row3:R1:P2          9
row3:R2:P1         -4
row3:R2:P2         -6
row3:R3:P1         -1
row3:R3:P2          0
row3:R4:P1          1
row3:R4:P2          6
row3:R5:P1          0
row3:R5:P2          0
row4:R1:P1         -7
row4:R1:P2         11
row4:R2:P1         -7
row4:R2:P2          0
row4:R3:P1          2
row4:R3:P2          5
row4:R4:P1          2
row4:R4:P2          8
row4:R5:P1          0
row4:R5:P2          0
row5:R1:P1          0
row5:R1:P2          0
row5:R2:P1          0
row5:R2:P2          0
row5:R3:P1          0
row5:R3:P2          0
row5:R4:P1          0
row5:R4:P2          0
row5:R5:P1          0
row5:R5:P2          0
P1:S1              -1
P1:S2               1
P1:S3               0
P1:S4               0
P2:S1               0
P2:S2               0
P2:S3               0
P2:S4               0
row1:P1:S1          3
row1:P1:S2          3
row1:P1:S3          1
row1:P1:S4          0
row1:P2:S1         -2
row1:P2:S2          1
row1:P2:S3         -1
row1:P2:S4          0
row2:P1:S1          3
```

```
row2:P1:S2          -3
row2:P1:S3           1
row2:P1:S4           0
row2:P2:S1           1
row2:P2:S2          -1
row2:P2:S3          -6
row2:P2:S4           0
row3:P1:S1          -5
row3:P1:S2           0
row3:P1:S3           0
row3:P1:S4           0
row3:P2:S1          -1
row3:P2:S2          -7
row3:P2:S3           0
row3:P2:S4           0
row4:P1:S1           0
row4:P1:S2          -1
row4:P1:S3          -2
row4:P1:S4           0
row4:P2:S1           3
row4:P2:S2           5
row4:P2:S3           1
row4:P2:S4           0
row5:P1:S1           0
row5:P1:S2           0
row5:P1:S3           0
row5:P1:S4           0
row5:P2:S1           0
row5:P2:S2           0
row5:P2:S3           0
row5:P2:S4           0
R1:P1:S1            -9
R1:P1:S2           -11
R1:P1:S3            -7
R1:P1:S4             0
R1:P2:S1             0
R1:P2:S2             0
R1:P2:S3             0
R1:P2:S4             0
R2:P1:S1             0
R2:P1:S2             1
R2:P1:S3            -3
R2:P1:S4             0
R2:P2:S1             0
R2:P2:S2             0
R2:P2:S3             0
R2:P2:S4             0
R3:P1:S1            -6
```

```
R3:P1:S2            -7
R3:P1:S3            -6
R3:P1:S4             0
R3:P2:S1             0
R3:P2:S2             0
R3:P2:S3             0
R3:P2:S4             0
R4:P1:S1            -7
R4:P1:S2            -8
R4:P1:S3            -6
R4:P1:S4             0
R4:P2:S1             0
R4:P2:S2             0
R4:P2:S3             0
R4:P2:S4             0
R5:P1:S1             0
R5:P1:S2             0
R5:P1:S3             0
R5:P1:S4             0
R5:P2:S1             0
R5:P2:S2             0
R5:P2:S3             0
R5:P2:S4             0
row1:R1:P1:S1        1
row1:R1:P1:S2        6
row1:R1:P1:S3        0
row1:R1:P1:S4        0
row1:R1:P2:S1       -8
row1:R1:P2:S2      -11
row1:R1:P2:S3       -4
row1:R1:P2:S4        0
row1:R2:P1:S1        0
row1:R2:P1:S2       -3
row1:R2:P1:S3        2
row1:R2:P1:S4        0
row1:R2:P2:S1       -5
row1:R2:P2:S2        0
row1:R2:P2:S3        4
row1:R2:P2:S4        0
row1:R3:P1:S1       -1
row1:R3:P1:S2       -7
row1:R3:P1:S3       -1
row1:R3:P1:S4        0
row1:R3:P2:S1       -2
row1:R3:P2:S2       -6
row1:R3:P2:S3       -5
row1:R3:P2:S4        0
row1:R4:P1:S1       -1
```

```
row1:R4:P1:S2      -2
row1:R4:P1:S3      -2
row1:R4:P1:S4       0
row1:R4:P2:S1      -3
row1:R4:P2:S2      -8
row1:R4:P2:S3      -7
row1:R4:P2:S4       0
row1:R5:P1:S1       0
row1:R5:P1:S2       0
row1:R5:P1:S3       0
row1:R5:P1:S4       0
row1:R5:P2:S1       0
row1:R5:P2:S2       0
row1:R5:P2:S3       0
row1:R5:P2:S4       0
row2:R1:P1:S1      -1
row2:R1:P1:S2       1
row2:R1:P1:S3       0
row2:R1:P1:S4       0
row2:R1:P2:S1      -9
row2:R1:P2:S2      -6
row2:R1:P2:S3      -1
row2:R1:P2:S4       0
row2:R2:P1:S1      -6
row2:R2:P1:S2       2
row2:R2:P1:S3       2
row2:R2:P1:S4       0
row2:R2:P2:S1      -6
row2:R2:P2:S2       4
row2:R2:P2:S3       6
row2:R2:P2:S4       0
row2:R3:P1:S1       4
row2:R3:P1:S2      10
row2:R3:P1:S3       6
row2:R3:P1:S4       0
row2:R3:P2:S1      -3
row2:R3:P2:S2      -2
row2:R3:P2:S3      -3
row2:R3:P2:S4       0
row2:R4:P1:S1      -1
row2:R4:P1:S2       6
row2:R4:P1:S3       4
row2:R4:P1:S4       0
row2:R4:P2:S1      -7
row2:R4:P2:S2      -5
row2:R4:P2:S3      -1
row2:R4:P2:S4       0
row2:R5:P1:S1       0
```

```
row2:R5:P1:S2          0
row2:R5:P1:S3          0
row2:R5:P1:S4          0
row2:R5:P2:S1          0
row2:R5:P2:S2          0
row2:R5:P2:S3          0
row2:R5:P2:S4          0
row3:R1:P1:S1          5
row3:R1:P1:S2          0
row3:R1:P1:S3          0
row3:R1:P1:S4          0
row3:R1:P2:S1        -10
row3:R1:P2:S2         -2
row3:R1:P2:S3         -6
row3:R1:P2:S4          0
row3:R2:P1:S1          6
row3:R2:P1:S2          4
row3:R2:P1:S3          7
row3:R2:P1:S4          0
row3:R2:P2:S1         -1
row3:R2:P2:S2          9
row3:R2:P2:S3         -2
row3:R2:P2:S4          0
row3:R3:P1:S1          9
row3:R3:P1:S2         -2
row3:R3:P1:S3          2
row3:R3:P1:S4          0
row3:R3:P2:S1         -5
row3:R3:P2:S2          0
row3:R3:P2:S3         -5
row3:R3:P2:S4          0
row3:R4:P1:S1          3
row3:R4:P1:S2         -1
row3:R4:P1:S3         -1
row3:R4:P1:S4          0
row3:R4:P2:S1        -14
row3:R4:P2:S2         -3
row3:R4:P2:S3         -6
row3:R4:P2:S4          0
row3:R5:P1:S1          0
row3:R5:P1:S2          0
row3:R5:P1:S3          0
row3:R5:P1:S4          0
row3:R5:P2:S1          0
row3:R5:P2:S2          0
row3:R5:P2:S3          0
row3:R5:P2:S4          0
row4:R1:P1:S1          1
```

```
row4:R1:P1:S2        3
row4:R1:P1:S3        8
row4:R1:P1:S4        0
row4:R1:P2:S1      -11
row4:R1:P2:S2      -13
row4:R1:P2:S3       -7
row4:R1:P2:S4        0
row4:R2:P1:S1        1
row4:R2:P1:S2        2
row4:R2:P1:S3        6
row4:R2:P1:S4        0
row4:R2:P2:S1       -1
row4:R2:P2:S2        0
row4:R2:P2:S3        1
row4:R2:P2:S4        0
row4:R3:P1:S1        3
row4:R3:P1:S2        0
row4:R3:P1:S3        4
row4:R3:P1:S4        0
row4:R3:P2:S1       -4
row4:R3:P2:S2       -9
row4:R3:P2:S3       -1
row4:R3:P2:S4        0
row4:R4:P1:S1        2
row4:R4:P1:S2       -2
row4:R4:P1:S3        2
row4:R4:P1:S4        0
row4:R4:P2:S1      -17
row4:R4:P2:S2      -19
row4:R4:P2:S3      -14
row4:R4:P2:S4        0
row4:R5:P1:S1        0
row4:R5:P1:S2        0
row4:R5:P1:S3        0
row4:R5:P1:S4        0
row4:R5:P2:S1        0
row4:R5:P2:S2        0
row4:R5:P2:S3        0
row4:R5:P2:S4        0
row5:R1:P1:S1        0
row5:R1:P1:S2        0
row5:R1:P1:S3        0
row5:R1:P1:S4        0
row5:R1:P2:S1        0
row5:R1:P2:S2        0
row5:R1:P2:S3        0
row5:R1:P2:S4        0
row5:R2:P1:S1        0
```

```
row5:R2:P1:S2        0
row5:R2:P1:S3        0
row5:R2:P1:S4        0
row5:R2:P2:S1        0
row5:R2:P2:S2        0
row5:R2:P2:S3        0
row5:R2:P2:S4        0
row5:R3:P1:S1        0
row5:R3:P1:S2        0
row5:R3:P1:S3        0
row5:R3:P1:S4        0
row5:R3:P2:S1        0
row5:R3:P2:S2        0
row5:R3:P2:S3        0
row5:R3:P2:S4        0
row5:R4:P1:S1        0
row5:R4:P1:S2        0
row5:R4:P1:S3        0
row5:R4:P1:S4        0
row5:R4:P2:S1        0
row5:R4:P2:S2        0
row5:R4:P2:S3        0
row5:R4:P2:S4        0
row5:R5:P1:S1        0
row5:R5:P1:S2        0
row5:R5:P1:S3        0
row5:R5:P1:S4        0
row5:R5:P2:S1        0
row5:R5:P2:S2        0
row5:R5:P2:S3        0
row5:R5:P2:S4        0
```

7.7   Example 5.1

(81) MODEL

```
ex5.1 = read.table("C:/G/Rt/Split/sbsp.txt", header=TRUE)
ex5.1 = af(ex5.1, c("R", "A", "C", "B", "Tx"))
GLM(Y ~ R + A + R:A + C + B + C:B + Tx + B:Tx, ex5.1)
```

```
$ANOVA
Response : Y
                Df  Sum Sq Mean Sq F value     Pr(>F)
MODEL           20 193.583  9.6792  9.4176 2.969e-05 ***
RESIDUALS       15  15.417  1.0278
CORRECTED TOTAL 35 209.000
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
     Df  Sum Sq Mean Sq F value    Pr(>F)
R     2  33.500 16.7500 16.2973 0.0001734 ***
A     1  16.000 16.0000 15.5676 0.0012951 **
R:A   2  32.167 16.0833 15.6486 0.0002133 ***
C     2   0.500  0.2500  0.2432 0.7871141
B     1   1.778  1.7778  1.7297 0.2081966
C:B   2   0.389  0.1944  0.1892 0.8295745
Tx    5 103.333 20.6667 20.1081  3.63e-06 ***
B:Tx  5   5.917  1.1833  1.1514 0.3770453
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
     Df  Sum Sq Mean Sq F value    Pr(>F)
R     2  23.047 11.5236 11.2122 0.0010520 **
A     1  12.375 12.3751 12.0406 0.0034285 **
R:A   2  27.164 13.5819 13.2148 0.0004907 ***
C     2   0.500  0.2500  0.2432 0.7871141
B     1   1.778  1.7778  1.7297 0.2081966
C:B   2   0.389  0.1944  0.1892 0.8295745
Tx    5 103.333 20.6667 20.1081  3.63e-06 ***
B:Tx  5   5.917  1.1833  1.1514 0.3770453
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
     Df  Sum Sq Mean Sq F value    Pr(>F)
R     2  22.451 11.2254 10.9220 0.0011828 **
A     1  15.001 15.0013 14.5958 0.0016719 **
R:A   2  27.164 13.5819 13.2148 0.0004907 ***
C     2   0.500  0.2500  0.2432 0.7871141
B     1   1.778  1.7778  1.7297 0.2081966
C:B   2   0.389  0.1944  0.1892 0.8295745
Tx    5 103.333 20.6667 20.1081  3.63e-06 ***
B:Tx  5   5.917  1.1833  1.1514 0.3770453
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   8.0833    0.86156  9.3822 1.149e-07 ***
R1           -0.5417    0.67056 -0.8078 0.4318411
R2           -0.1250    0.62082 -0.2013 0.8431323
R3            0.0000    0.00000
```

```
A1              -0.4167     0.67056 -0.6214 0.5436847
A2               0.0000     0.00000
R1:A1            0.4375     0.98160  0.4457 0.6621795
R1:A2            0.0000     0.00000
R2:A1           -3.7292     0.91382 -4.0808 0.0009837 ***
R2:A2            0.0000     0.00000
R3:A1            0.0000     0.00000
R3:A2            0.0000     0.00000
C1               0.5000     0.58531  0.8542 0.4064073
C2               0.3333     0.58531  0.5695 0.5774500
C3               0.0000     0.00000
B1               0.1250     1.03470  0.1208 0.9054464
B2               0.0000     0.00000
C1:B1           -0.5000     0.82776 -0.6040 0.5548431
C1:B2            0.0000     0.00000
C2:B1           -0.1667     0.82776 -0.2013 0.8431323
C2:B2            0.0000     0.00000
C3:B1            0.0000     0.00000
C3:B2            0.0000     0.00000
Tx1             -5.4792     0.89008 -6.1558 1.839e-05 ***
Tx2             -2.7083     0.85323 -3.1742 0.0062873 **
Tx3             -1.2292     0.89008 -1.3810 0.1875206
Tx4             -0.9167     0.89008 -1.0299 0.3193930
Tx5             -2.2917     0.89008 -2.5747 0.0211374 *
Tx6              0.0000     0.00000
B1:Tx1           1.6250     1.34112  1.2117 0.2443809
B1:Tx2          -0.2500     1.24164 -0.2013 0.8431323
B1:Tx3           1.1250     1.34112  0.8388 0.4147227
B1:Tx4           1.5000     1.34112  1.1185 0.2809609
B1:Tx5          -0.7500     1.34112 -0.5592 0.5842567
B1:Tx6           0.0000     0.00000
B2:Tx1           0.0000     0.00000
B2:Tx2           0.0000     0.00000
B2:Tx3           0.0000     0.00000
B2:Tx4           0.0000     0.00000
B2:Tx5           0.0000     0.00000
B2:Tx6           0.0000     0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

 (82) MODEL

```
GLM(Y ~ R + A + A:R + C + B + C:B + Tx + A:Tx, ex5.1)
```

```
$ANOVA
Response : Y
            Df  Sum Sq Mean Sq F value    Pr(>F)
```

```
MODEL          20 194.188  9.7094  9.8323 2.254e-05 ***
RESIDUALS      15  14.813  0.9875
CORRECTED TOTAL 35 209.000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
    Df  Sum Sq Mean Sq F value    Pr(>F)
R    2  33.500 16.7500 16.9620 0.0001410 ***
A    1  16.000 16.0000 16.2025 0.0011013 **
R:A  2  32.167 16.0833 16.2869 0.0001739 ***
C    2   0.500  0.2500  0.2532 0.7795913
B    1   1.778  1.7778  1.8003 0.1996385
C:B  2   0.389  0.1944  0.1969 0.8233570
Tx   5 103.333 20.6667 20.9283 2.813e-06 ***
A:Tx 5   6.521  1.3042  1.3207 0.3078554
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
    Df  Sum Sq Mean Sq F value    Pr(>F)
R    2  33.500 16.7500 16.9620 0.0001410 ***
A    1  16.000 16.0000 16.2025 0.0011013 **
R:A  2  32.167 16.0833 16.2869 0.0001739 ***
C    2   0.807  0.4037  0.4088 0.6716130
B    1   1.757  1.7574  1.7797 0.2020905
C:B  2   0.030  0.0150  0.0152 0.9849064
Tx   5 103.333 20.6667 20.9283 2.813e-06 ***
A:Tx 5   6.521  1.3042  1.3207 0.3078554
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
    Df  Sum Sq Mean Sq F value    Pr(>F)
R    2  33.500 16.7500 16.9620 0.0001410 ***
A    1  16.000 16.0000 16.2025 0.0011013 **
R:A  2  32.167 16.0833 16.2869 0.0001739 ***
C    2   0.780  0.3902  0.3952 0.6803789
B    1   1.776  1.7756  1.7980 0.1999029
C:B  2   0.030  0.0150  0.0152 0.9849064
Tx   5 103.333 20.6667 20.9283 2.813e-06 ***
A:Tx 5   6.521  1.3042  1.3207 0.3078554
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
           Estimate Std. Error t value  Pr(>|t|)
(Intercept)  7.7083    0.84451  9.1276 1.638e-07 ***
```

```
R1               -0.3333    0.57373 -0.5810   0.569873
R2               -0.1667    0.57373 -0.2905   0.775414
R3                0.0000    0.00000
A1                0.2292    1.01422  0.2260   0.824288
A2                0.0000    0.00000
R1:A1            -0.3333    0.81138 -0.4108   0.687010
R1:A2             0.0000    0.00000
R2:A1            -4.1667    0.81138 -5.1353   0.000122 ***
R2:A2             0.0000    0.00000
R3:A1             0.0000    0.00000
R3:A2             0.0000    0.00000
C1                0.0625    0.65729  0.0951   0.925504
C2                0.4375    0.60853  0.7189   0.483227
C3                0.0000    0.00000
B1                0.5938    0.65729  0.9033   0.380630
B2                0.0000    0.00000
C1:B1            -0.0625    0.89574 -0.0698   0.945294
C1:B2             0.0000    0.00000
C2:B1            -0.1563    0.89574 -0.1744   0.863854
C2:B2             0.0000    0.00000
C3:B1             0.0000    0.00000
C3:B2             0.0000    0.00000
Tx1              -4.8854    0.87247 -5.5995 5.070e-05 ***
Tx2              -2.5208    0.83635 -3.0141   0.008719 **
Tx3              -0.8854    0.87247 -1.0148   0.326271
Tx4               0.7083    0.87247  0.8119   0.429560
Tx5              -3.2292    0.87247 -3.7012   0.002134 **
Tx6               0.0000    0.00000
A1:Tx1            0.4375    1.31458  0.3328   0.743887
A1:Tx2           -0.6250    1.21707 -0.5135   0.615061
A1:Tx3            0.4375    1.31458  0.3328   0.743887
A1:Tx4           -1.7500    1.31458 -1.3312   0.202996
A1:Tx5            1.1250    1.31458  0.8558   0.405580
A1:Tx6            0.0000    0.00000
A2:Tx1            0.0000    0.00000
A2:Tx2            0.0000    0.00000
A2:Tx3            0.0000    0.00000
A2:Tx4            0.0000    0.00000
A2:Tx5            0.0000    0.00000
A2:Tx6            0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(83) MODEL

```
GLM(Y ~ R + A + A:R + C + B + B:C + Tx + A:Tx + B:Tx, ex5.1)
```

$ANOVA

```
Response : Y
                Df  Sum Sq Mean Sq F value    Pr(>F)
MODEL           24 196.238  8.1766  7.0476 0.0008758 ***
RESIDUALS       11  12.762  1.1602
CORRECTED TOTAL 35 209.000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
     Df  Sum Sq Mean Sq F value    Pr(>F)
R     2  33.500 16.7500 14.4373 0.0008391 ***
A     1  16.000 16.0000 13.7908 0.0034197 **
R:A   2  32.167 16.0833 13.8626 0.0009856 ***
C     2   0.500  0.2500  0.2155 0.8094766
B     1   1.778  1.7778  1.5323 0.2415358
C:B   2   0.389  0.1944  0.1676 0.8478141
Tx    5 103.333 20.6667 17.8131 6.055e-05 ***
A:Tx  5   6.521  1.3042  1.1241 0.4027183
B:Tx  4   2.050  0.5126  0.4418 0.7761730
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
     Df  Sum Sq Mean Sq F value   Pr(>F)
R     2  23.116 11.5581  9.9622 0.003396 **
A     1  12.375 12.3751 10.6664 0.007519 **
R:A   2  27.426 13.7132 11.8197 0.001820 **
C     2   0.970  0.4850  0.4180 0.668392
B     1   1.757  1.7574  1.5148 0.244080
C:B   2   0.085  0.0424  0.0366 0.964202
Tx    5 103.333 20.6667 17.8131 6.055e-05 ***
A:Tx  4   2.655  0.6636  0.5720 0.688652
B:Tx  4   2.050  0.5126  0.4418 0.776173
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
CAUTION: Singularity Exists !
     Df  Sum Sq Mean Sq F value   Pr(>F)
R     2  22.186 11.0928  9.5611 0.003924 **
A     1  15.185 15.1853 13.0886 0.004042 **
R:A   2  27.426 13.7132 11.8197 0.001820 **
C     2   1.010  0.5049  0.4352 0.657839
B     1   1.792  1.7922  1.5448 0.239751
C:B   2   0.085  0.0424  0.0366 0.964202
Tx    5 103.333 20.6667 17.8131 6.055e-05 ***
A:Tx  4   2.655  0.6636  0.5720 0.688652
B:Tx  4   2.050  0.5126  0.4418 0.776173
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   7.9545    0.98427  8.0817  5.93e-06 ***
R1           -0.6318    0.73222 -0.8629 0.4066247
R2           -0.1636    0.66557 -0.2459 0.8103184
R3            0.0000    0.00000
A1            0.2273    1.10928  0.2049 0.8414057
A2            0.0000    0.00000
R1:A1         0.4636    1.09010  0.4253 0.6788082
R1:A2         0.0000    0.00000
R2:A1        -3.7682    0.98951 -3.8081 0.0029022 **
R2:A2         0.0000    0.00000
R3:A1         0.0000    0.00000
R3:A2         0.0000    0.00000
C1            0.2682    0.73222  0.3663 0.7211200
C2            0.4364    0.66557  0.6556 0.5255407
C3            0.0000    0.00000
B1           -0.2409    1.17470 -0.2051 0.8412545
B2            0.0000    0.00000
C1:B1        -0.2318    0.98951 -0.2343 0.8190745
C1:B2         0.0000    0.00000
C2:B1         0.0318    0.98951  0.0322 0.9749241
C2:B2         0.0000    0.00000
C3:B1         0.0000    0.00000
C3:B2         0.0000    0.00000
Tx1          -5.3485    1.04397 -5.1232 0.0003318 ***
Tx2          -2.5152    1.00973 -2.4909 0.0299872 *
Tx3          -1.1667    1.04397 -1.1175 0.2875828
Tx4           0.2424    1.22954  0.1972 0.8472929
Tx5          -2.6167    1.17171 -2.2332 0.0472599 *
Tx6           0.0000    0.00000
A1:Tx1       -0.4182    1.59983 -0.2614 0.7986202
A1:Tx2       -0.6182    1.42305 -0.4344 0.6723913
A1:Tx3       -0.2000    1.59983 -0.1250 0.9027684
A1:Tx4       -2.0091    1.51170 -1.3290 0.2107461
A1:Tx5       -0.1000    1.98612 -0.0503 0.9607465
A1:Tx6        0.0000    0.00000
A2:Tx1        0.0000    0.00000
A2:Tx2        0.0000    0.00000
A2:Tx3        0.0000    0.00000
A2:Tx4        0.0000    0.00000
A2:Tx5        0.0000    0.00000
A2:Tx6        0.0000    0.00000
B1:Tx1        1.7818    1.59983  1.1138 0.2891291
B1:Tx2       -0.0182    1.42305 -0.0128 0.9900347
```

```
B1:Tx3          1.2000      1.59983  0.7501 0.4689466
B1:Tx4          1.1909      1.51170  0.7878 0.4474596
B1:Tx5          0.0000      0.00000
B1:Tx6          0.0000      0.00000
B2:Tx1          0.0000      0.00000
B2:Tx2          0.0000      0.00000
B2:Tx3          0.0000      0.00000
B2:Tx4          0.0000      0.00000
B2:Tx5          0.0000      0.00000
B2:Tx6          0.0000      0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
alias(Y ~ R + A + A:R + C + B + B:C + Tx + A:Tx + B:Tx, ex5.1)
```

```
Model :
Y ~ R + A + A:R + C + B + B:C + Tx + A:Tx + B:Tx

Complete :
       (Intercept) R1   R2    A1    C1   C2    B1    Tx1   Tx2   Tx3   Tx4   Tx5   R1:A1
B1:Tx5      0            0    0  -1/5    0    0  -1/5     0     0     0     0     0     0
       R2:A1 C1:B1 C2:B1 A1:Tx1 A1:Tx2 A1:Tx3 A1:Tx4 A1:Tx5 B1:Tx1 B1:Tx2 B1:Tx3
B1:Tx5     0     0     0    1/5    1/5    1/5    1/5     -1    1/5    1/5    1/5
       B1:Tx4
B1:Tx5  1/5
```

```r
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(Y ~ R + A + A:R + C + B + B:C + Tx + A:Tx + B:Tx, ex5.1),
      type=3, singular.ok=TRUE) # NOT OK
```

```
Note: model has aliased coefficients
      sums of squares computed by model comparison


Anova Table (Type III tests)

Response: Y
          Sum Sq Df F values     Pr(>F)
R         22.186  2   9.5611   0.003924 **
A          0.000  0
C          1.010  2   0.4352   0.657839
B          0.000  0
Tx       103.333  5  17.8131 6.055e-05 ***
R:A       27.426  2  11.8197   0.001820 **
C:B        0.085  2   0.0366   0.964202
A:Tx       2.655  4   0.5720   0.688652
B:Tx       2.050  4   0.4418   0.776173
```

```
Residuals  12.762 11
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


 (84) MODEL
```

```
GLM(Y ~ R + A + A:R + C + B + C:B + Tx + A:Tx + B:Tx + A:B:Tx, ex5.1)
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value   Pr(>F)
MODEL           28  204.2  7.2929  10.635 0.001719 **
RESIDUALS        7    4.8  0.6857
CORRECTED TOTAL 35  209.0
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
       Df  Sum Sq Mean Sq F value     Pr(>F)
R       2  33.500 16.7500 24.4271 0.0006969 ***
A       1  16.000 16.0000 23.3333 0.0018985 **
R:A     2  32.167 16.0833 23.4549 0.0007889 ***
C       2   0.500  0.2500  0.3646 0.7069339
B       1   1.778  1.7778  2.5926 0.1513998
C:B     2   0.389  0.1944  0.2836 0.7613494
Tx      5 103.333 20.6667 30.1389 0.0001357 ***
A:Tx    5   6.521  1.3042  1.9019 0.2123307
B:Tx    4   2.050  0.5126  0.7475 0.5896365
A:B:Tx  4   7.962  1.9905  2.9029 0.1038803
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
       Df  Sum Sq Mean Sq F value     Pr(>F)
R       2  31.838 15.9191 23.2153 0.0008139 ***
A       1  12.375 12.3751 18.0470 0.0038017 **
R:A     1   2.017  2.0174  2.9420 0.1300172
C       2   0.500  0.2500  0.3645 0.7069558
B       1   1.757  1.7574  2.5629 0.1534298
C:B     1   0.644  0.6445  0.9399 0.3646045
Tx      5 103.333 20.6667 30.1389 0.0001357 ***
A:Tx    4   2.655  0.6636  0.9678 0.4812226
B:Tx    4   2.050  0.5126  0.7475 0.5896365
A:B:Tx  4   7.962  1.9905  2.9029 0.1038803
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
CAUTION: Singularity Exists !
       Df  Sum Sq Mean Sq F value    Pr(>F)
R       2  28.112 14.0562 20.4986 0.0011846 **
A       1  14.655 14.6551 21.3720 0.0024176 **
R:A     1   2.017  2.0174  2.9420 0.1300172
C       2   0.471  0.2356  0.3436 0.7205632
B       1   1.769  1.7694  2.5804 0.1522328
C:B     1   0.644  0.6445  0.9399 0.3646045
Tx      5 103.815 20.7630 30.2793 0.0001336 ***
A:Tx    4   2.951  0.7378  1.0760 0.4358837
B:Tx    4   3.553  0.8882  1.2954 0.3579988
A:B:Tx  4   7.962  1.9905  2.9029 0.1038803
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   8.5833    0.86189  9.9587 2.199e-05 ***
R1           -1.2833    0.79282 -1.6187 0.1495477
R2           -0.0500    0.55549 -0.0900 0.9308004
R3            0.0000    0.00000
A1           -0.5833    0.98561 -0.5918 0.5725621
A2            0.0000    0.00000
R1:A1         1.7250    1.00570  1.7152 0.1300172
R1:A2         0.0000    0.00000
R2:A1        -3.4083    1.01136 -3.3700 0.0119197 *
R2:A2         0.0000    0.00000
R3:A1         0.0000    0.00000
R3:A2         0.0000    0.00000
C1           -0.3833    0.79282 -0.4835 0.6434958
C2            0.5500    0.55549  0.9901 0.3551012
C3            0.0000    0.00000
B1           -0.4417    0.94112 -0.4693 0.6531236
B2            0.0000    0.00000
C1:B1         0.2833    0.96806  0.2927 0.7782513
C1:B2         0.0000    0.00000
C2:B1        -0.6917    0.82462 -0.8388 0.4293080
C2:B2         0.0000    0.00000
C3:B1         0.0000    0.00000
C3:B2         0.0000    0.00000
Tx1          -5.8333    0.95618 -6.1006 0.0004908 ***
Tx2          -2.2500    0.92582 -2.4303 0.0454020 *
Tx3          -1.8333    0.95618 -1.9173 0.0967067 .
Tx4           2.0833    1.37321  1.5171 0.1730222
Tx5          -2.6167    0.90079 -2.9048 0.0228276 *
Tx6           0.0000    0.00000
A1:Tx1       -0.2250    1.75173 -0.1284 0.9014099
```

```
A1:Tx2      -1.3000     1.69706 -0.7660 0.4686960
A1:Tx3       0.6750     1.75173  0.3853 0.7114327
A1:Tx4      -4.8500     1.70713 -2.8410 0.0250077 *
A1:Tx5      -0.1000     1.52690 -0.0655 0.9496134
A1:Tx6       0.0000     0.00000
A2:Tx1       0.0000     0.00000
A2:Tx2       0.0000     0.00000
A2:Tx3       0.0000     0.00000
A2:Tx4       0.0000     0.00000
A2:Tx5       0.0000     0.00000
A2:Tx6       0.0000     0.00000
B1:Tx1       1.9750     1.75173  1.1275 0.2967084
B1:Tx2      -0.7000     1.69706 -0.4125 0.6923283
B1:Tx3       2.0750     1.75173  1.1845 0.2748540
B1:Tx4      -1.6500     1.70713 -0.9665 0.3659742
B1:Tx5       0.0000     0.00000
B1:Tx6       0.0000     0.00000
B2:Tx1       0.0000     0.00000
B2:Tx2       0.0000     0.00000
B2:Tx3       0.0000     0.00000
B2:Tx4       0.0000     0.00000
B2:Tx5       0.0000     0.00000
B2:Tx6       0.0000     0.00000
A1:B1:Tx1    0.8750     2.32379  0.3765 0.7176693
A1:B1:Tx2    1.2500     2.37847  0.5255 0.6154343
A1:B1:Tx3   -0.6250     2.32379 -0.2690 0.7957174
A1:B1:Tx4    6.0000     2.02837  2.9580 0.0211639 *
A1:B1:Tx5    0.0000     0.00000
A1:B1:Tx6    0.0000     0.00000
A1:B2:Tx1    0.0000     0.00000
A1:B2:Tx2    0.0000     0.00000
A1:B2:Tx3    0.0000     0.00000
A1:B2:Tx4    0.0000     0.00000
A1:B2:Tx5    0.0000     0.00000
A1:B2:Tx6    0.0000     0.00000
A2:B1:Tx1    0.0000     0.00000
A2:B1:Tx2    0.0000     0.00000
A2:B1:Tx3    0.0000     0.00000
A2:B1:Tx4    0.0000     0.00000
A2:B1:Tx5    0.0000     0.00000
A2:B1:Tx6    0.0000     0.00000
A2:B2:Tx1    0.0000     0.00000
A2:B2:Tx2    0.0000     0.00000
A2:B2:Tx3    0.0000     0.00000
A2:B2:Tx4    0.0000     0.00000
A2:B2:Tx5    0.0000     0.00000
A2:B2:Tx6    0.0000     0.00000
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
alias(Y ~ R + A + A:R + C + B + C:B + Tx + A:Tx + B:Tx + A:B:Tx, ex5.1)
```

```
Model :
Y ~ R + A + A:R + C + B + C:B + Tx + A:Tx + B:Tx + A:B:Tx

Complete :
          (Intercept) R1   R2    A1    C1   C2    B1   Tx1   Tx2   Tx3   Tx4   Tx5
B1:Tx5         0            0    0  -1/5    0    0  -1/5    0     0     0     0     0
A1:B1:Tx5   -1/6            0    0     0    0    0     0   1/6   1/6   1/6   1/6  -5/6
A1:B1:Tx6      0          2/3    0  4/45  2/3 -2/3  4/45  -1/3   1/3  -1/3    0     0
          R1:A1 R2:A1 C1:B1 C2:B1 A1:Tx1 A1:Tx2 A1:Tx3 A1:Tx4 A1:Tx5 B1:Tx1
B1:Tx5        0     0     0     0    1/5    1/5    1/5    1/5     -1    1/5
A1:B1:Tx5     0     0     0     0      0      0      0      0      0      0
A1:B1:Tx6  -2/9   4/9  -2/9  -2/9   -1/5   -1/5   -1/5    4/5      0   -1/5
          B1:Tx2 B1:Tx3 B1:Tx4 A1:B1:Tx1 A1:B1:Tx2 A1:B1:Tx3 A1:B1:Tx4
B1:Tx5       1/5    1/5    1/5         0         0         0         0
A1:B1:Tx5      0      0      0         0         0         0         0
A1:B1:Tx6   -1/5   -1/5    4/5         1        -1         1         0
```

```r
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(Y ~ R + A + A:R + C + B + C:B + Tx + A:Tx + B:Tx + A:B:Tx, ex5.1),
      type=3, singular.ok=TRUE) # NOT OK
```

```
Note: model has aliased coefficients
      sums of squares computed by model comparison


Anova Table (Type III tests)

Response: Y
          Sum Sq Df F values   Pr(>F)
R         11.643  1  16.9793 0.004456 **
A          0.000  0
C          0.002  1   0.0025 0.961483
B          0.000  0
Tx        89.178  3  43.3503 6.87e-05 ***
R:A        2.017  1   2.9420 0.130017
C:B        0.644  1   0.9399 0.364604
A:Tx       0.543  3   0.2640 0.849381
B:Tx       3.384  3   1.6451 0.264128
A:B:Tx     7.962  4   2.9029 0.103880
Residuals  4.800  7
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.8 Example 7.1

(85) MODEL

```
ex7.1 = read.table("C:/G/Rt/Split/asped.txt", header=TRUE)
ex7.1 = af(ex7.1, c("R", "G", "F"))
GLM(Y ~ R + G + R:G + F + F:G, ex7.1)
```

```
$ANOVA
Response : Y
                 Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            95 577.83  6.0824  5.3082 1.068e-05 ***
RESIDUALS        24  27.50  1.1458
CORRECTED TOTAL 119 605.33
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
     Df Sum Sq Mean Sq F value    Pr(>F)
R     3  84.76 28.2528 24.6570 1.655e-07 ***
G    27 343.48 12.7216 11.1025 4.286e-08 ***
R:G   9  11.75  1.3056  1.1394    0.3749
F     2  59.85 29.9250 26.1164 9.481e-07 ***
G:F  54  77.98  1.4441  1.2603    0.2718
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
     Df Sum Sq Mean Sq F value    Pr(>F)
R     3   5.75  1.9167  1.6727    0.1994
G    27 343.48 12.7216 11.1025 4.286e-08 ***
R:G   9  11.75  1.3056  1.1394    0.3749
F     2  59.85 29.9250 26.1164 9.481e-07 ***
G:F  54  77.98  1.4441  1.2603    0.2718
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
     Df Sum Sq Mean Sq F value    Pr(>F)
R     3   5.75  1.9167  1.6727    0.1994
G    27 343.48 12.7216 11.1025 4.286e-08 ***
R:G   9  11.75  1.3056  1.1394    0.3749
F     2  50.51 25.2525 22.0385 3.686e-06 ***
G:F  54  77.98  1.4441  1.2603    0.2718
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   4.0000    1.38193  2.8945 0.007962 **
R1            0.3333    0.87401  0.3814 0.706273
R2            0.0000    0.87401  0.0000 1.000000
R3           -0.3333    0.87401 -0.3814 0.706273
R4            0.0000    0.00000
G1            2.6667    1.74801  1.5255 0.140196
G10           1.0000    1.51383  0.6606 0.515174
G11           4.0000    1.51383  2.6423 0.014268 *
G12           3.0000    1.51383  1.9817 0.059074 .
G13           5.3333    1.74801  3.0511 0.005495 **
G14           4.3333    1.74801  2.4790 0.020593 *
G15           2.3333    1.74801  1.3348 0.194452
G16           5.3333    1.74801  3.0511 0.005495 **
G17           4.3333    1.74801  2.4790 0.020593 *
G18           4.3333    1.74801  2.4790 0.020593 *
G19           5.0000    1.74801  2.8604 0.008625 **
G2            0.6667    1.74801  0.3814 0.706273
G20           4.0000    1.74801  2.2883 0.031224 *
G21           4.0000    1.74801  2.2883 0.031224 *
G22           5.0000    1.74801  2.8604 0.008625 **
G23           5.0000    1.74801  2.8604 0.008625 **
G24           5.0000    1.74801  2.8604 0.008625 **
G25           2.9167    1.57564  1.8511 0.076500 .
G26           1.6667    1.57564  1.0578 0.300691
G27           5.0833    1.57564  3.2262 0.003604 **
G28           4.0000    1.31101  3.0511 0.005495 **
G3            1.6667    1.74801  0.9535 0.349861
G4           -0.3333    1.74801 -0.1907 0.850370
G5            3.6667    1.74801  2.0976 0.046650 *
G6            2.6667    1.74801  1.5255 0.140196
G7           -1.0000    1.51383 -0.6606 0.515174
G8            1.0000    1.51383  0.6606 0.515174
G9            0.0000    0.00000
R1:G1         0.0000    0.00000
R1:G10        0.0000    0.00000
R1:G11        0.0000    0.00000
R1:G12        0.0000    0.00000
R1:G13        0.0000    0.00000
R1:G14        0.0000    0.00000
R1:G15        0.0000    0.00000
R1:G16        0.0000    0.00000
R1:G17        0.0000    0.00000
R1:G18        0.0000    0.00000
R1:G19        0.0000    0.00000
R1:G2         0.0000    0.00000
R1:G20        0.0000    0.00000
```

```
R1:G21          0.0000     0.00000
R1:G22          0.0000     0.00000
R1:G23          0.0000     0.00000
R1:G24          0.0000     0.00000
R1:G25         -1.3333     1.23603 -1.0787 0.291435
R1:G26         -1.3333     1.23603 -1.0787 0.291435
R1:G27         -0.6667     1.23603 -0.5394 0.594608
R1:G28          0.0000     0.00000
R1:G3           0.0000     0.00000
R1:G4           0.0000     0.00000
R1:G5           0.0000     0.00000
R1:G6           0.0000     0.00000
R1:G7           0.0000     0.00000
R1:G8           0.0000     0.00000
R1:G9           0.0000     0.00000
R2:G1           0.0000     0.00000
R2:G10          0.0000     0.00000
R2:G11          0.0000     0.00000
R2:G12          0.0000     0.00000
R2:G13          0.0000     0.00000
R2:G14          0.0000     0.00000
R2:G15          0.0000     0.00000
R2:G16          0.0000     0.00000
R2:G17          0.0000     0.00000
R2:G18          0.0000     0.00000
R2:G19          0.0000     0.00000
R2:G2           0.0000     0.00000
R2:G20          0.0000     0.00000
R2:G21          0.0000     0.00000
R2:G22          0.0000     0.00000
R2:G23          0.0000     0.00000
R2:G24          0.0000     0.00000
R2:G25         -0.6667     1.23603 -0.5394 0.594608
R2:G26         -1.3333     1.23603 -1.0787 0.291435
R2:G27         -1.0000     1.23603 -0.8090 0.426440
R2:G28          0.0000     0.00000
R2:G3           0.0000     0.00000
R2:G4           0.0000     0.00000
R2:G5           0.0000     0.00000
R2:G6           0.0000     0.00000
R2:G7           0.0000     0.00000
R2:G8           0.0000     0.00000
R2:G9           0.0000     0.00000
R3:G1           0.0000     0.00000
R3:G10          0.0000     0.00000
R3:G11          0.0000     0.00000
R3:G12          0.0000     0.00000
R3:G13          0.0000     0.00000
```

```
R3:G14          0.0000      0.00000
R3:G15          0.0000      0.00000
R3:G16          0.0000      0.00000
R3:G17          0.0000      0.00000
R3:G18          0.0000      0.00000
R3:G19          0.0000      0.00000
R3:G2           0.0000      0.00000
R3:G20          0.0000      0.00000
R3:G21          0.0000      0.00000
R3:G22          0.0000      0.00000
R3:G23          0.0000      0.00000
R3:G24          0.0000      0.00000
R3:G25          1.3333      1.23603   1.0787 0.291435
R3:G26          1.0000      1.23603   0.8090 0.426440
R3:G27         -0.6667      1.23603  -0.5394 0.594608
R3:G28          0.0000      0.00000
R3:G3           0.0000      0.00000
R3:G4           0.0000      0.00000
R3:G5           0.0000      0.00000
R3:G6           0.0000      0.00000
R3:G7           0.0000      0.00000
R3:G8           0.0000      0.00000
R3:G9           0.0000      0.00000
R4:G1           0.0000      0.00000
R4:G10          0.0000      0.00000
R4:G11          0.0000      0.00000
R4:G12          0.0000      0.00000
R4:G13          0.0000      0.00000
R4:G14          0.0000      0.00000
R4:G15          0.0000      0.00000
R4:G16          0.0000      0.00000
R4:G17          0.0000      0.00000
R4:G18          0.0000      0.00000
R4:G19          0.0000      0.00000
R4:G2           0.0000      0.00000
R4:G20          0.0000      0.00000
R4:G21          0.0000      0.00000
R4:G22          0.0000      0.00000
R4:G23          0.0000      0.00000
R4:G24          0.0000      0.00000
R4:G25          0.0000      0.00000
R4:G26          0.0000      0.00000
R4:G27          0.0000      0.00000
R4:G28          0.0000      0.00000
R4:G3           0.0000      0.00000
R4:G4           0.0000      0.00000
R4:G5           0.0000      0.00000
R4:G6           0.0000      0.00000
```

```
R4:G7           0.0000    0.00000
R4:G8           0.0000    0.00000
R4:G9           0.0000    0.00000
F1             -1.0000    1.51383 -0.6606 0.515174
F2              0.0000    1.51383  0.0000 1.000000
F3              0.0000    0.00000
G1:F1          -4.0000    2.14087 -1.8684 0.073962 .
G1:F2          -2.0000    2.14087 -0.9342 0.359506
G1:F3           0.0000    0.00000
G10:F1          0.0000    2.14087  0.0000 1.000000
G10:F2         -1.0000    2.14087 -0.4671 0.644642
G10:F3          0.0000    0.00000
G11:F1          1.0000    2.14087  0.4671 0.644642
G11:F2          0.0000    2.14087  0.0000 1.000000
G11:F3          0.0000    0.00000
G12:F1         -3.0000    2.14087 -1.4013 0.173924
G12:F2         -2.0000    2.14087 -0.9342 0.359506
G12:F3          0.0000    0.00000
G13:F1         -1.0000    2.14087 -0.4671 0.644642
G13:F2         -2.0000    2.14087 -0.9342 0.359506
G13:F3          0.0000    0.00000
G14:F1         -2.0000    2.14087 -0.9342 0.359506
G14:F2         -2.0000    2.14087 -0.9342 0.359506
G14:F3          0.0000    0.00000
G15:F1         -2.0000    2.14087 -0.9342 0.359506
G15:F2         -1.0000    2.14087 -0.4671 0.644642
G15:F3          0.0000    0.00000
G16:F1         -1.0000    2.14087 -0.4671 0.644642
G16:F2         -2.0000    2.14087 -0.9342 0.359506
G16:F3          0.0000    0.00000
G17:F1         -1.0000    2.14087 -0.4671 0.644642
G17:F2          0.0000    2.14087  0.0000 1.000000
G17:F3          0.0000    0.00000
G18:F1         -2.0000    2.14087 -0.9342 0.359506
G18:F2         -1.0000    2.14087 -0.4671 0.644642
G18:F3          0.0000    0.00000
G19:F1         -3.0000    2.14087 -1.4013 0.173924
G19:F2         -1.0000    2.14087 -0.4671 0.644642
G19:F3          0.0000    0.00000
G2:F1          -1.0000    2.14087 -0.4671 0.644642
G2:F2           1.0000    2.14087  0.4671 0.644642
G2:F3           0.0000    0.00000
G20:F1         -1.0000    2.14087 -0.4671 0.644642
G20:F2         -2.0000    2.14087 -0.9342 0.359506
G20:F3          0.0000    0.00000
G21:F1          0.0000    2.14087  0.0000 1.000000
G21:F2         -4.0000    2.14087 -1.8684 0.073962 .
G21:F3          0.0000    0.00000
```

```
G22:F1          0.0000      2.14087   0.0000 1.000000
G22:F2         -2.0000      2.14087  -0.9342 0.359506
G22:F3          0.0000      0.00000
G23:F1          1.0000      2.14087   0.4671 0.644642
G23:F2         -1.0000      2.14087  -0.4671 0.644642
G23:F3          0.0000      0.00000
G24:F1          1.0000      2.14087   0.4671 0.644642
G24:F2         -1.0000      2.14087  -0.4671 0.644642
G24:F3          0.0000      0.00000
G25:F1         -2.5000      1.69251  -1.4771 0.152652
G25:F2         -2.2500      1.69251  -1.3294 0.196219
G25:F3          0.0000      0.00000
G26:F1         -1.7500      1.69251  -1.0340 0.311458
G26:F2         -2.2500      1.69251  -1.3294 0.196219
G26:F3          0.0000      0.00000
G27:F1          1.0000      1.69251   0.5908 0.560152
G27:F2         -0.2500      1.69251  -0.1477 0.883806
G27:F3          0.0000      0.00000
G28:F1          1.0000      1.69251   0.5908 0.560152
G28:F2          0.0000      1.69251   0.0000 1.000000
G28:F3          0.0000      0.00000
G3:F1          -1.0000      2.14087  -0.4671 0.644642
G3:F2           1.0000      2.14087   0.4671 0.644642
G3:F3           0.0000      0.00000
G4:F1           2.0000      2.14087   0.9342 0.359506
G4:F2           4.0000      2.14087   1.8684 0.073962 .
G4:F3           0.0000      0.00000
G5:F1          -1.0000      2.14087  -0.4671 0.644642
G5:F2           0.0000      2.14087   0.0000 1.000000
G5:F3           0.0000      0.00000
G6:F1           1.0000      2.14087   0.4671 0.644642
G6:F2           1.0000      2.14087   0.4671 0.644642
G6:F3           0.0000      0.00000
G7:F1          -1.0000      2.14087  -0.4671 0.644642
G7:F2          -1.0000      2.14087  -0.4671 0.644642
G7:F3           0.0000      0.00000
G8:F1          -2.0000      2.14087  -0.9342 0.359506
G8:F2          -2.0000      2.14087  -0.9342 0.359506
G8:F3           0.0000      0.00000
G9:F1           0.0000      0.00000
G9:F2           0.0000      0.00000
G9:F3           0.0000      0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(Y ~ R + G + R:G + F + F:G, ex7.1), type=3, singular.ok=TRUE) # NOT OK
```

```
Note: model has aliased coefficients
      sums of squares computed by model comparison


Anova Table (Type III tests)

Response: Y
          Sum Sq Df F values    Pr(>F)
R          0.000  0
G        202.417  3  58.8848 3.258e-11 ***
F         50.505  2  22.0385 3.686e-06 ***
R:G       11.750  9   1.1394    0.3749
G:F       77.983 54   1.2603    0.2718
Residuals 27.500 24
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.9 Example 7.2

(86) MODEL

```
ex7.2 = read.table("C:/G/Rt/Split/aspedt.txt", header=TRUE)
ex7.2 = af(ex7.2, c("R", "T", "G"))
GLM(Y ~ R + T + R:T + G + G:T, ex7.2)
```

```
$ANOVA
Response : Y
                 Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            99 538.70  5.4415  5.1892 1.286e-05 ***
RESIDUALS        24  25.17  1.0486
CORRECTED TOTAL 123 563.87
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
    Df  Sum Sq Mean Sq F value    Pr(>F)
R    3  73.255 24.4183 23.2863 2.752e-07 ***
T    3  32.000 10.6667 10.1722 0.0001645 ***
R:T  9  28.402  3.1558  3.0095 0.0149568 *
G   21 309.908 14.7575 14.0734 7.158e-09 ***
T:G 63  95.140  1.5102  1.4401 0.1617931
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
    Df  Sum Sq Mean Sq F value    Pr(>F)
R    3   4.229  1.4097  1.3444 0.2834998
```

```
T    3  32.000 10.6667 10.1722 0.0001645 ***
R:T  9  10.854  1.2060  1.1501 0.3684706
G   21 309.908 14.7575 14.0734 7.158e-09 ***
T:G 63  95.140  1.5102  1.4401 0.1617931
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
    Df  Sum Sq Mean Sq F value    Pr(>F)
R    3   4.229  1.4097  1.3444  0.283500
T    3  22.668  7.5559  7.2056  0.001299 **
R:T  9  10.854  1.2060  1.1501  0.368471
G   21 309.908 14.7575 14.0734 7.158e-09 ***
T:G 63  95.140  1.5102  1.4401  0.161793
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   7.3333    1.32200  5.5471 1.048e-05 ***
R1           -0.6667    0.83611 -0.7973 0.4330680
R2           -0.3333    0.83611 -0.3987 0.6936589
R3           -1.3333    0.83611 -1.5947 0.1238666
R4            0.0000    0.00000
T1           -3.3333    1.86959 -1.7829 0.0872539 .
T2           -2.0000    1.86959 -1.0698 0.2953720
T3           -0.3333    1.86959 -0.1783 0.8599900
T4            0.0000    0.00000
R1:T1        -0.6667    1.18243 -0.5638 0.5781149
R1:T2         0.3333    1.18243  0.2819 0.7804333
R1:T3         1.6667    1.18243  1.4095 0.1715077
R1:T4         0.0000    0.00000
R2:T1         0.3333    1.18243  0.2819 0.7804333
R2:T2         0.0000    1.18243  0.0000 1.0000000
R2:T3        -0.6667    1.18243 -0.5638 0.5781149
R2:T4         0.0000    0.00000
R3:T1         1.0000    1.18243  0.8457 0.4060656
R3:T2         0.3333    1.18243  0.2819 0.7804333
R3:T3         0.6667    1.18243  0.5638 0.5781149
R3:T4         0.0000    0.00000
R4:T1         0.0000    0.00000
R4:T2         0.0000    0.00000
R4:T3         0.0000    0.00000
R4:T4         0.0000    0.00000
G1           -3.6667    1.67221 -2.1927 0.0382606 *
G10           0.0000    1.44818  0.0000 1.0000000
G11           0.0000    1.67221  0.0000 1.0000000
G12           0.0000    1.67221  0.0000 1.0000000
```

```
G13           -2.0000      1.67221 -1.1960 0.2433719
G14           -4.0000      1.67221 -2.3920 0.0249405 *
G15            1.0000      1.67221  0.5980 0.5554350
G16           -1.3333      1.67221 -0.7973 0.4330680
G17           -1.3333      1.67221 -0.7973 0.4330680
G18           -0.3333      1.67221 -0.1993 0.8436786
G19            0.6667      1.67221  0.3987 0.6936589
G2            -2.6667      1.67221 -1.5947 0.1238666
G20           -1.2500      1.25416 -0.9967 0.3288617
G21           -2.5000      1.25416 -1.9934 0.0577070 .
G22           -0.2500      1.25416 -0.1993 0.8436786
G3            -1.6667      1.67221 -0.9967 0.3288617
G4            -4.6667      1.67221 -2.7907 0.0101456 *
G5            -2.6667      1.67221 -1.5947 0.1238666
G6            -2.0000      1.44818 -1.3810 0.1799904
G7            -3.0000      1.44818 -2.0716 0.0492199 *
G8            -2.0000      1.44818 -1.3810 0.1799904
G9             0.0000      0.00000
T1:G1          9.0000      2.36487  3.8057 0.0008596 ***
T1:G10         5.0000      2.04803  2.4414 0.0223806 *
T1:G11         5.3333      2.36487  2.2552 0.0335125 *
T1:G12         5.3333      2.36487  2.2552 0.0335125 *
T1:G13        -0.6667      2.36487 -0.2819 0.7804333
T1:G14         2.3333      2.36487  0.9867 0.3336497
T1:G15         4.3333      2.36487  1.8324 0.0793324 .
T1:G16         6.3333      2.36487  2.6781 0.0131499 *
T1:G17         6.3333      2.36487  2.6781 0.0131499 *
T1:G18         5.3333      2.36487  2.2552 0.0335125 *
T1:G19         4.3333      2.36487  1.8324 0.0793324 .
T1:G2          7.0000      2.36487  2.9600 0.0068231 **
T1:G20         4.6667      1.77365  2.6311 0.0146356 *
T1:G21         4.6667      1.77365  2.6311 0.0146356 *
T1:G22         3.6667      1.77365  2.0673 0.0496526 *
T1:G3          5.0000      2.36487  2.1143 0.0450700 *
T1:G4          7.0000      2.36487  2.9600 0.0068231 **
T1:G5          9.0000      2.36487  3.8057 0.0008596 ***
T1:G6          1.0000      2.04803  0.4883 0.6297879
T1:G7          2.0000      2.04803  0.9765 0.3385352
T1:G8          2.0000      2.04803  0.9765 0.3385352
T1:G9          0.0000      0.00000
T2:G1          7.6667      2.36487  3.2419 0.0034696 **
T2:G10         2.0000      2.04803  0.9765 0.3385352
T2:G11         4.6667      2.36487  1.9733 0.0600798 .
T2:G12         2.6667      2.36487  1.1276 0.2706286
T2:G13        -0.3333      2.36487 -0.1410 0.8890840
T2:G14         0.6667      2.36487  0.2819 0.7804333
T2:G15         3.6667      2.36487  1.5505 0.1341152
T2:G16         4.0000      2.36487  1.6914 0.1037018
```

```
T2:G17          5.0000     2.36487   2.1143 0.0450700 *
T2:G18          2.0000     2.36487   0.8457 0.4060656
T2:G19          0.0000     2.36487   0.0000 1.0000000
T2:G2           5.6667     2.36487   2.3962 0.0247152 *
T2:G20          4.8333     1.77365   2.7251 0.0118067 *
T2:G21          2.5833     1.77365   1.4565 0.1582118
T2:G22          3.5833     1.77365   2.0203 0.0546461 .
T2:G3           1.6667     2.36487   0.7048 0.4877422
T2:G4           4.6667     2.36487   1.9733 0.0600798 .
T2:G5           5.6667     2.36487   2.3962 0.0247152 *
T2:G6           0.0000     2.04803   0.0000 1.0000000
T2:G7           0.0000     2.04803   0.0000 1.0000000
T2:G8          -1.0000     2.04803  -0.4883 0.6297879
T2:G9           0.0000     0.00000
T3:G1           0.6667     2.36487   0.2819 0.7804333
T3:G10          1.0000     2.04803   0.4883 0.6297879
T3:G11          0.6667     2.36487   0.2819 0.7804333
T3:G12          0.6667     2.36487   0.2819 0.7804333
T3:G13         -1.3333     2.36487  -0.5638 0.5781149
T3:G14         -0.3333     2.36487  -0.1410 0.8890840
T3:G15          0.6667     2.36487   0.2819 0.7804333
T3:G16          1.3333     2.36487   0.5638 0.5781149
T3:G17          1.3333     2.36487   0.5638 0.5781149
T3:G18          2.3333     2.36487   0.9867 0.3336497
T3:G19          1.3333     2.36487   0.5638 0.5781149
T3:G2           0.6667     2.36487   0.2819 0.7804333
T3:G20          0.9167     1.77365   0.5168 0.6100085
T3:G21          0.6667     1.77365   0.3759 0.7103135
T3:G22          0.4167     1.77365   0.2349 0.8162632
T3:G3           0.6667     2.36487   0.2819 0.7804333
T3:G4           0.6667     2.36487   0.2819 0.7804333
T3:G5           0.6667     2.36487   0.2819 0.7804333
T3:G6          -1.0000     2.04803  -0.4883 0.6297879
T3:G7           0.0000     2.04803   0.0000 1.0000000
T3:G8          -1.0000     2.04803  -0.4883 0.6297879
T3:G9           0.0000     0.00000
T4:G1           0.0000     0.00000
T4:G10          0.0000     0.00000
T4:G11          0.0000     0.00000
T4:G12          0.0000     0.00000
T4:G13          0.0000     0.00000
T4:G14          0.0000     0.00000
T4:G15          0.0000     0.00000
T4:G16          0.0000     0.00000
T4:G17          0.0000     0.00000
T4:G18          0.0000     0.00000
T4:G19          0.0000     0.00000
T4:G2           0.0000     0.00000
```

```
T4:G20        0.0000    0.00000
T4:G21        0.0000    0.00000
T4:G22        0.0000    0.00000
T4:G3         0.0000    0.00000
T4:G4         0.0000    0.00000
T4:G5         0.0000    0.00000
T4:G6         0.0000    0.00000
T4:G7         0.0000    0.00000
T4:G8         0.0000    0.00000
T4:G9         0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.10   Example 7.3

(87) MODEL

```
ex7.3 = read.table("C:/G/Rt/Split/assped.txt", header=TRUE)
ex7.3 = af(ex7.3, c("R", "T", "G", "F"))
GLM(Y ~ R + T + R:T + G + G:T + R:T:G + F + F:T + F:G + F:G:T, ex7.3)
```

```
$ANOVA
Response : Y
                 Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           155 656.12  4.2330  13.446 3.997e-14 ***
RESIDUALS        36  11.33  0.3148
CORRECTED TOTAL 191 667.45
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
      Df Sum Sq Mean Sq  F value    Pr(>F)
R      3  27.06   9.019  28.6489 1.203e-09 ***
T      1  10.55  10.547  33.5018 1.334e-06 ***
R:T    3   2.97   0.991   3.1489  0.036705 *
G     22 389.01  17.682  56.1668 < 2.2e-16 ***
T:G   22  18.42   0.837   2.6601  0.004445 **
R:T:G 12   8.78   0.731   2.3235  0.025315 *
F      2 164.28  82.141 260.9173 < 2.2e-16 ***
T:F    2   0.84   0.422   1.3401  0.274574
G:F   44  23.47   0.533   1.6943  0.053191 .
T:G:F 44  10.74   0.244   0.7753  0.790640
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
```

```
        Df Sum Sq Mean Sq  F value      Pr(>F)
R        3  12.49   4.162  13.2206 5.655e-06 ***
T        1  10.55  10.547  33.5018 1.334e-06 ***
R:T      3   1.15   0.384   1.2206  0.316281
G       22 389.01  17.682  56.1668 < 2.2e-16 ***
T:G     22  18.42   0.837   2.6601  0.004445 **
R:T:G 12    8.78   0.731   2.3235  0.025315 *
F        2 164.28  82.141 260.9173 < 2.2e-16 ***
T:F      2   0.84   0.422   1.3401  0.274574
G:F     44  23.47   0.533   1.6943  0.053191 .
T:G:F 44  10.74   0.244   0.7753  0.790640
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
        Df Sum Sq Mean Sq  F value      Pr(>F)
R        3  12.49   4.162  13.2206 5.655e-06 ***
T        1  11.16  11.158  35.4430 8.021e-07 ***
R:T      3   1.15   0.384   1.2206  0.316281
G       22 389.01  17.682  56.1668 < 2.2e-16 ***
T:G     22  18.42   0.837   2.6601  0.004445 **
R:T:G 12    8.78   0.731   2.3235  0.025315 *
F        2 120.56  60.282 191.4828 < 2.2e-16 ***
T:F      2   0.82   0.411   1.3060  0.283432
G:F     44  23.47   0.533   1.6943  0.053191 .
T:G:F 44  10.74   0.244   0.7753  0.790640
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)  10.0000    0.72436 13.8054 4.441e-16 ***
R1           -1.0000    0.45812 -2.1828 0.0356525 *
R2           -1.0000    0.45812 -2.1828 0.0356525 *
R3            0.0000    0.45812  0.0000 1.0000000
R4            0.0000    0.00000
T1           -0.6667    1.02439 -0.6508 0.5193136
T2            0.0000    0.00000
R1:T1         0.3333    0.64788  0.5145 0.6100498
R1:T2         0.0000    0.00000
R2:T1         0.6667    0.64788  1.0290 0.3103479
R2:T2         0.0000    0.00000
R3:T1         0.0000    0.64788  0.0000 1.0000000
R3:T2         0.0000    0.00000
R4:T1         0.0000    0.00000
R4:T2         0.0000    0.00000
G1           -4.0000    0.91625 -4.3656 0.0001024 ***
G10          -2.0000    0.79349 -2.5205 0.0162919 *
```

```
G11          -4.0000      0.91625 -4.3656 0.0001024 ***
G12          -1.0000      0.91625 -1.0914 0.2823433
G13          -1.0000      0.91625 -1.0914 0.2823433
G14          -2.0000      0.91625 -2.1828 0.0356525 *
G15          -3.0000      0.91625 -3.2742 0.0023455 **
G16          -6.0000      0.91625 -6.5485 1.294e-07 ***
G17          -4.0000      0.91625 -4.3656 0.0001024 ***
G18          -3.0000      0.91625 -3.2742 0.0023455 **
G19          -3.0000      0.91625 -3.2742 0.0023455 **
G2           -1.0000      0.91625 -1.0914 0.2823433
G20          -2.0000      0.91625 -2.1828 0.0356525 *
G21          -3.0000      0.82589 -3.6324 0.0008677 ***
G22          -1.3333      0.82589 -1.6144 0.1151698
G23          -1.0000      0.68718 -1.4552 0.1542753
G3            0.0000      0.91625  0.0000 1.0000000
G4            0.0000      0.91625  0.0000 1.0000000
G5            0.0000      0.91625  0.0000 1.0000000
G6           -2.0000      0.79349 -2.5205 0.0162919 *
G7           -2.0000      0.79349 -2.5205 0.0162919 *
G8           -1.0000      0.79349 -1.2603 0.2156865
G9            0.0000      0.00000
T1:G1         1.3333      1.29577  1.0290 0.3103479
T1:G10       -1.0000      1.12217 -0.8911 0.3787754
T1:G11        0.6667      1.29577  0.5145 0.6100498
T1:G12       -0.3333      1.29577 -0.2572 0.7984521
T1:G13       -1.3333      1.29577 -1.0290 0.3103479
T1:G14        1.6667      1.29577  1.2862 0.2065706
T1:G15       -2.3333      1.29577 -1.8007 0.0801274 .
T1:G16        1.6667      1.29577  1.2862 0.2065706
T1:G17       -0.3333      1.29577 -0.2572 0.7984521
T1:G18       -0.3333      1.29577 -0.2572 0.7984521
T1:G19        0.6667      1.29577  0.5145 0.6100498
T1:G2        -0.6667      1.29577 -0.5145 0.6100498
T1:G20       -0.3333      1.29577 -0.2572 0.7984521
T1:G21        1.5833      1.16799  1.3556 0.1836683
T1:G22       -0.5833      1.16799 -0.4994 0.6205124
T1:G23        0.4167      0.97183  0.4287 0.6706625
T1:G3         0.3333      1.29577  0.2572 0.7984521
T1:G4         0.3333      1.29577  0.2572 0.7984521
T1:G5         0.3333      1.29577  0.2572 0.7984521
T1:G6        -1.0000      1.12217 -0.8911 0.3787754
T1:G7         1.0000      1.12217  0.8911 0.3787754
T1:G8         1.0000      1.12217  0.8911 0.3787754
T1:G9         0.0000      0.00000
T2:G1         0.0000      0.00000
T2:G10        0.0000      0.00000
T2:G11        0.0000      0.00000
T2:G12        0.0000      0.00000
```

```
T2:G13        0.0000      0.00000
T2:G14        0.0000      0.00000
T2:G15        0.0000      0.00000
T2:G16        0.0000      0.00000
T2:G17        0.0000      0.00000
T2:G18        0.0000      0.00000
T2:G19        0.0000      0.00000
T2:G2         0.0000      0.00000
T2:G20        0.0000      0.00000
T2:G21        0.0000      0.00000
T2:G22        0.0000      0.00000
T2:G23        0.0000      0.00000
T2:G3         0.0000      0.00000
T2:G4         0.0000      0.00000
T2:G5         0.0000      0.00000
T2:G6         0.0000      0.00000
T2:G7         0.0000      0.00000
T2:G8         0.0000      0.00000
T2:G9         0.0000      0.00000
R1:T1:G1      0.0000      0.00000
R1:T1:G10     0.0000      0.00000
R1:T1:G11     0.0000      0.00000
R1:T1:G12     0.0000      0.00000
R1:T1:G13     0.0000      0.00000
R1:T1:G14     0.0000      0.00000
R1:T1:G15     0.0000      0.00000
R1:T1:G16     0.0000      0.00000
R1:T1:G17     0.0000      0.00000
R1:T1:G18     0.0000      0.00000
R1:T1:G19     0.0000      0.00000
R1:T1:G2      0.0000      0.00000
R1:T1:G20     0.0000      0.00000
R1:T1:G21    -1.0000      0.64788 -1.5435 0.1314585
R1:T1:G22     0.0000      0.64788  0.0000 1.0000000
R1:T1:G23     0.0000      0.00000
R1:T1:G3      0.0000      0.00000
R1:T1:G4      0.0000      0.00000
R1:T1:G5      0.0000      0.00000
R1:T1:G6      0.0000      0.00000
R1:T1:G7      0.0000      0.00000
R1:T1:G8      0.0000      0.00000
R1:T1:G9      0.0000      0.00000
R1:T2:G1      0.0000      0.00000
R1:T2:G10     0.0000      0.00000
R1:T2:G11     0.0000      0.00000
R1:T2:G12     0.0000      0.00000
R1:T2:G13     0.0000      0.00000
R1:T2:G14     0.0000      0.00000
```

```
R1:T2:G15     0.0000     0.00000
R1:T2:G16     0.0000     0.00000
R1:T2:G17     0.0000     0.00000
R1:T2:G18     0.0000     0.00000
R1:T2:G19     0.0000     0.00000
R1:T2:G2      0.0000     0.00000
R1:T2:G20     0.0000     0.00000
R1:T2:G21     0.6667     0.64788   1.0290 0.3103479
R1:T2:G22     0.0000     0.64788   0.0000 1.0000000
R1:T2:G23     0.0000     0.00000
R1:T2:G3      0.0000     0.00000
R1:T2:G4      0.0000     0.00000
R1:T2:G5      0.0000     0.00000
R1:T2:G6      0.0000     0.00000
R1:T2:G7      0.0000     0.00000
R1:T2:G8      0.0000     0.00000
R1:T2:G9      0.0000     0.00000
R2:T1:G1      0.0000     0.00000
R2:T1:G10     0.0000     0.00000
R2:T1:G11     0.0000     0.00000
R2:T1:G12     0.0000     0.00000
R2:T1:G13     0.0000     0.00000
R2:T1:G14     0.0000     0.00000
R2:T1:G15     0.0000     0.00000
R2:T1:G16     0.0000     0.00000
R2:T1:G17     0.0000     0.00000
R2:T1:G18     0.0000     0.00000
R2:T1:G19     0.0000     0.00000
R2:T1:G2      0.0000     0.00000
R2:T1:G20     0.0000     0.00000
R2:T1:G21    -1.0000     0.64788 -1.5435 0.1314585
R2:T1:G22    -0.3333     0.64788 -0.5145 0.6100498
R2:T1:G23     0.0000     0.00000
R2:T1:G3      0.0000     0.00000
R2:T1:G4      0.0000     0.00000
R2:T1:G5      0.0000     0.00000
R2:T1:G6      0.0000     0.00000
R2:T1:G7      0.0000     0.00000
R2:T1:G8      0.0000     0.00000
R2:T1:G9      0.0000     0.00000
R2:T2:G1      0.0000     0.00000
R2:T2:G10     0.0000     0.00000
R2:T2:G11     0.0000     0.00000
R2:T2:G12     0.0000     0.00000
R2:T2:G13     0.0000     0.00000
R2:T2:G14     0.0000     0.00000
R2:T2:G15     0.0000     0.00000
R2:T2:G16     0.0000     0.00000
```

```
R2:T2:G17      0.0000      0.00000
R2:T2:G18      0.0000      0.00000
R2:T2:G19      0.0000      0.00000
R2:T2:G2       0.0000      0.00000
R2:T2:G20      0.0000      0.00000
R2:T2:G21     -1.0000      0.64788 -1.5435 0.1314585
R2:T2:G22      0.3333      0.64788  0.5145 0.6100498
R2:T2:G23      0.0000      0.00000
R2:T2:G3       0.0000      0.00000
R2:T2:G4       0.0000      0.00000
R2:T2:G5       0.0000      0.00000
R2:T2:G6       0.0000      0.00000
R2:T2:G7       0.0000      0.00000
R2:T2:G8       0.0000      0.00000
R2:T2:G9       0.0000      0.00000
R3:T1:G1       0.0000      0.00000
R3:T1:G10      0.0000      0.00000
R3:T1:G11      0.0000      0.00000
R3:T1:G12      0.0000      0.00000
R3:T1:G13      0.0000      0.00000
R3:T1:G14      0.0000      0.00000
R3:T1:G15      0.0000      0.00000
R3:T1:G16      0.0000      0.00000
R3:T1:G17      0.0000      0.00000
R3:T1:G18      0.0000      0.00000
R3:T1:G19      0.0000      0.00000
R3:T1:G2       0.0000      0.00000
R3:T1:G20      0.0000      0.00000
R3:T1:G21     -1.6667      0.64788 -2.5725 0.0143678 *
R3:T1:G22      0.6667      0.64788  1.0290 0.3103479
R3:T1:G23      0.0000      0.00000
R3:T1:G3       0.0000      0.00000
R3:T1:G4       0.0000      0.00000
R3:T1:G5       0.0000      0.00000
R3:T1:G6       0.0000      0.00000
R3:T1:G7       0.0000      0.00000
R3:T1:G8       0.0000      0.00000
R3:T1:G9       0.0000      0.00000
R3:T2:G1       0.0000      0.00000
R3:T2:G10      0.0000      0.00000
R3:T2:G11      0.0000      0.00000
R3:T2:G12      0.0000      0.00000
R3:T2:G13      0.0000      0.00000
R3:T2:G14      0.0000      0.00000
R3:T2:G15      0.0000      0.00000
R3:T2:G16      0.0000      0.00000
R3:T2:G17      0.0000      0.00000
R3:T2:G18      0.0000      0.00000
```

```
R3:T2:G19     0.0000     0.00000
R3:T2:G2      0.0000     0.00000
R3:T2:G20     0.0000     0.00000
R3:T2:G21    -0.6667     0.64788 -1.0290 0.3103479
R3:T2:G22     0.0000     0.64788  0.0000 1.0000000
R3:T2:G23     0.0000     0.00000
R3:T2:G3      0.0000     0.00000
R3:T2:G4      0.0000     0.00000
R3:T2:G5      0.0000     0.00000
R3:T2:G6      0.0000     0.00000
R3:T2:G7      0.0000     0.00000
R3:T2:G8      0.0000     0.00000
R3:T2:G9      0.0000     0.00000
R4:T1:G1      0.0000     0.00000
R4:T1:G10     0.0000     0.00000
R4:T1:G11     0.0000     0.00000
R4:T1:G12     0.0000     0.00000
R4:T1:G13     0.0000     0.00000
R4:T1:G14     0.0000     0.00000
R4:T1:G15     0.0000     0.00000
R4:T1:G16     0.0000     0.00000
R4:T1:G17     0.0000     0.00000
R4:T1:G18     0.0000     0.00000
R4:T1:G19     0.0000     0.00000
R4:T1:G2      0.0000     0.00000
R4:T1:G20     0.0000     0.00000
R4:T1:G21     0.0000     0.00000
R4:T1:G22     0.0000     0.00000
R4:T1:G23     0.0000     0.00000
R4:T1:G3      0.0000     0.00000
R4:T1:G4      0.0000     0.00000
R4:T1:G5      0.0000     0.00000
R4:T1:G6      0.0000     0.00000
R4:T1:G7      0.0000     0.00000
R4:T1:G8      0.0000     0.00000
R4:T1:G9      0.0000     0.00000
R4:T2:G1      0.0000     0.00000
R4:T2:G10     0.0000     0.00000
R4:T2:G11     0.0000     0.00000
R4:T2:G12     0.0000     0.00000
R4:T2:G13     0.0000     0.00000
R4:T2:G14     0.0000     0.00000
R4:T2:G15     0.0000     0.00000
R4:T2:G16     0.0000     0.00000
R4:T2:G17     0.0000     0.00000
R4:T2:G18     0.0000     0.00000
R4:T2:G19     0.0000     0.00000
R4:T2:G2      0.0000     0.00000
```

```
R4:T2:G20      0.0000    0.00000
R4:T2:G21      0.0000    0.00000
R4:T2:G22      0.0000    0.00000
R4:T2:G23      0.0000    0.00000
R4:T2:G3       0.0000    0.00000
R4:T2:G4       0.0000    0.00000
R4:T2:G5       0.0000    0.00000
R4:T2:G6       0.0000    0.00000
R4:T2:G7       0.0000    0.00000
R4:T2:G8       0.0000    0.00000
R4:T2:G9       0.0000    0.00000
F1            -2.0000    0.79349 -2.5205 0.0162919 *
F2            -2.0000    0.79349 -2.5205 0.0162919 *
F3             0.0000    0.00000
T1:F1          0.0000    1.12217  0.0000 1.0000000
T1:F2          1.0000    1.12217  0.8911 0.3787754
T1:F3          0.0000    0.00000
T2:F1          0.0000    0.00000
T2:F2          0.0000    0.00000
T2:F3          0.0000    0.00000
G1:F1          0.0000    1.12217  0.0000 1.0000000
G1:F2          1.0000    1.12217  0.8911 0.3787754
G1:F3          0.0000    0.00000
G10:F1        -1.0000    1.12217 -0.8911 0.3787754
G10:F2         0.0000    1.12217  0.0000 1.0000000
G10:F3         0.0000    0.00000
G11:F1         1.0000    1.12217  0.8911 0.3787754
G11:F2         1.0000    1.12217  0.8911 0.3787754
G11:F3         0.0000    0.00000
G12:F1         1.0000    1.12217  0.8911 0.3787754
G12:F2         1.0000    1.12217  0.8911 0.3787754
G12:F3         0.0000    0.00000
G13:F1         0.0000    1.12217  0.0000 1.0000000
G13:F2         0.0000    1.12217  0.0000 1.0000000
G13:F3         0.0000    0.00000
G14:F1         1.0000    1.12217  0.8911 0.3787754
G14:F2         2.0000    1.12217  1.7823 0.0831422 .
G14:F3         0.0000    0.00000
G15:F1        -1.0000    1.12217 -0.8911 0.3787754
G15:F2         0.0000    1.12217  0.0000 1.0000000
G15:F3         0.0000    0.00000
G16:F1         0.0000    1.12217  0.0000 1.0000000
G16:F2         0.0000    1.12217  0.0000 1.0000000
G16:F3         0.0000    0.00000
G17:F1        -1.0000    1.12217 -0.8911 0.3787754
G17:F2         1.0000    1.12217  0.8911 0.3787754
G17:F3         0.0000    0.00000
G18:F1        -1.0000    1.12217 -0.8911 0.3787754
```

```
G18:F2        1.0000    1.12217  0.8911 0.3787754
G18:F3        0.0000    0.00000
G19:F1        0.0000    1.12217  0.0000 1.0000000
G19:F2        2.0000    1.12217  1.7823 0.0831422 .
G19:F3        0.0000    0.00000
G2:F1        -2.0000    1.12217 -1.7823 0.0831422 .
G2:F2         0.0000    1.12217  0.0000 1.0000000
G2:F3         0.0000    0.00000
G20:F1        0.0000    1.12217  0.0000 1.0000000
G20:F2        1.0000    1.12217  0.8911 0.3787754
G20:F3        0.0000    0.00000
G21:F1       -1.2500    0.88715 -1.4090 0.1674134
G21:F2        1.2500    0.88715  1.4090 0.1674134
G21:F3        0.0000    0.00000
G22:F1        0.0000    0.88715  0.0000 1.0000000
G22:F2        1.0000    0.88715  1.1272 0.2671137
G22:F3        0.0000    0.00000
G23:F1        0.0000    0.88715  0.0000 1.0000000
G23:F2        1.0000    0.88715  1.1272 0.2671137
G23:F3        0.0000    0.00000
G3:F1         0.0000    1.12217  0.0000 1.0000000
G3:F2         1.0000    1.12217  0.8911 0.3787754
G3:F3         0.0000    0.00000
G4:F1         2.0000    1.12217  1.7823 0.0831422 .
G4:F2         1.0000    1.12217  0.8911 0.3787754
G4:F3         0.0000    0.00000
G5:F1         0.0000    1.12217  0.0000 1.0000000
G5:F2         2.0000    1.12217  1.7823 0.0831422 .
G5:F3         0.0000    0.00000
G6:F1         0.0000    1.12217  0.0000 1.0000000
G6:F2         1.0000    1.12217  0.8911 0.3787754
G6:F3         0.0000    0.00000
G7:F1         1.0000    1.12217  0.8911 0.3787754
G7:F2         2.0000    1.12217  1.7823 0.0831422 .
G7:F3         0.0000    0.00000
G8:F1         1.0000    1.12217  0.8911 0.3787754
G8:F2         3.0000    1.12217  2.6734 0.0112153 *
G8:F3         0.0000    0.00000
G9:F1         0.0000    0.00000
G9:F2         0.0000    0.00000
G9:F3         0.0000    0.00000
T1:G1:F1     -2.0000    1.58698 -1.2603 0.2156865
T1:G1:F2     -2.0000    1.58698 -1.2603 0.2156865
T1:G1:F3      0.0000    0.00000
T1:G10:F1     0.0000    1.58698  0.0000 1.0000000
T1:G10:F2     0.0000    1.58698  0.0000 1.0000000
T1:G10:F3     0.0000    0.00000
T1:G11:F1    -1.0000    1.58698 -0.6301 0.5325917
```

```
T1:G11:F2    -1.0000    1.58698 -0.6301 0.5325917
T1:G11:F3     0.0000    0.00000
T1:G12:F1     0.0000    1.58698  0.0000 1.0000000
T1:G12:F2     0.0000    1.58698  0.0000 1.0000000
T1:G12:F3     0.0000    0.00000
T1:G13:F1     1.0000    1.58698  0.6301 0.5325917
T1:G13:F2     1.0000    1.58698  0.6301 0.5325917
T1:G13:F3     0.0000    0.00000
T1:G14:F1    -1.0000    1.58698 -0.6301 0.5325917
T1:G14:F2    -3.0000    1.58698 -1.8904 0.0667786 .
T1:G14:F3     0.0000    0.00000
T1:G15:F1     1.0000    1.58698  0.6301 0.5325917
T1:G15:F2     0.0000    1.58698  0.0000 1.0000000
T1:G15:F3     0.0000    0.00000
T1:G16:F1    -2.0000    1.58698 -1.2603 0.2156865
T1:G16:F2    -1.0000    1.58698 -0.6301 0.5325917
T1:G16:F3     0.0000    0.00000
T1:G17:F1     0.0000    1.58698  0.0000 1.0000000
T1:G17:F2    -1.0000    1.58698 -0.6301 0.5325917
T1:G17:F3     0.0000    0.00000
T1:G18:F1     0.0000    1.58698  0.0000 1.0000000
T1:G18:F2    -2.0000    1.58698 -1.2603 0.2156865
T1:G18:F3     0.0000    0.00000
T1:G19:F1    -1.0000    1.58698 -0.6301 0.5325917
T1:G19:F2    -3.0000    1.58698 -1.8904 0.0667786 .
T1:G19:F3     0.0000    0.00000
T1:G2:F1      0.0000    1.58698  0.0000 1.0000000
T1:G2:F2     -1.0000    1.58698 -0.6301 0.5325917
T1:G2:F3      0.0000    0.00000
T1:G20:F1     0.0000    1.58698  0.0000 1.0000000
T1:G20:F2    -2.0000    1.58698 -1.2603 0.2156865
T1:G20:F3     0.0000    0.00000
T1:G21:F1     0.0000    1.25462  0.0000 1.0000000
T1:G21:F2    -1.7500    1.25462 -1.3948 0.1716105
T1:G21:F3     0.0000    0.00000
T1:G22:F1    -0.2500    1.25462 -0.1993 0.8431780
T1:G22:F2    -1.0000    1.25462 -0.7971 0.4306457
T1:G22:F3     0.0000    0.00000
T1:G23:F1    -0.2500    1.25462 -0.1993 0.8431780
T1:G23:F2    -1.0000    1.25462 -0.7971 0.4306457
T1:G23:F3     0.0000    0.00000
T1:G3:F1      0.0000    1.58698  0.0000 1.0000000
T1:G3:F2     -2.0000    1.58698 -1.2603 0.2156865
T1:G3:F3      0.0000    0.00000
T1:G4:F1     -1.0000    1.58698 -0.6301 0.5325917
T1:G4:F2     -1.0000    1.58698 -0.6301 0.5325917
T1:G4:F3      0.0000    0.00000
T1:G5:F1      1.0000    1.58698  0.6301 0.5325917
```

```
T1:G5:F2      -2.0000     1.58698 -1.2603 0.2156865
T1:G5:F3       0.0000     0.00000
T1:G6:F1       0.0000     1.58698  0.0000 1.0000000
T1:G6:F2      -1.0000     1.58698 -0.6301 0.5325917
T1:G6:F3       0.0000     0.00000
T1:G7:F1      -1.0000     1.58698 -0.6301 0.5325917
T1:G7:F2      -2.0000     1.58698 -1.2603 0.2156865
T1:G7:F3       0.0000     0.00000
T1:G8:F1      -1.0000     1.58698 -0.6301 0.5325917
T1:G8:F2      -3.0000     1.58698 -1.8904 0.0667786  .
T1:G8:F3       0.0000     0.00000
T1:G9:F1       0.0000     0.00000
T1:G9:F2       0.0000     0.00000
T1:G9:F3       0.0000     0.00000
T2:G1:F1       0.0000     0.00000
T2:G1:F2       0.0000     0.00000
T2:G1:F3       0.0000     0.00000
T2:G10:F1      0.0000     0.00000
T2:G10:F2      0.0000     0.00000
T2:G10:F3      0.0000     0.00000
T2:G11:F1      0.0000     0.00000
T2:G11:F2      0.0000     0.00000
T2:G11:F3      0.0000     0.00000
T2:G12:F1      0.0000     0.00000
T2:G12:F2      0.0000     0.00000
T2:G12:F3      0.0000     0.00000
T2:G13:F1      0.0000     0.00000
T2:G13:F2      0.0000     0.00000
T2:G13:F3      0.0000     0.00000
T2:G14:F1      0.0000     0.00000
T2:G14:F2      0.0000     0.00000
T2:G14:F3      0.0000     0.00000
T2:G15:F1      0.0000     0.00000
T2:G15:F2      0.0000     0.00000
T2:G15:F3      0.0000     0.00000
T2:G16:F1      0.0000     0.00000
T2:G16:F2      0.0000     0.00000
T2:G16:F3      0.0000     0.00000
T2:G17:F1      0.0000     0.00000
T2:G17:F2      0.0000     0.00000
T2:G17:F3      0.0000     0.00000
T2:G18:F1      0.0000     0.00000
T2:G18:F2      0.0000     0.00000
T2:G18:F3      0.0000     0.00000
T2:G19:F1      0.0000     0.00000
T2:G19:F2      0.0000     0.00000
T2:G19:F3      0.0000     0.00000
T2:G2:F1       0.0000     0.00000
```

```
T2:G2:F2        0.0000      0.00000
T2:G2:F3        0.0000      0.00000
T2:G20:F1       0.0000      0.00000
T2:G20:F2       0.0000      0.00000
T2:G20:F3       0.0000      0.00000
T2:G21:F1       0.0000      0.00000
T2:G21:F2       0.0000      0.00000
T2:G21:F3       0.0000      0.00000
T2:G22:F1       0.0000      0.00000
T2:G22:F2       0.0000      0.00000
T2:G22:F3       0.0000      0.00000
T2:G23:F1       0.0000      0.00000
T2:G23:F2       0.0000      0.00000
T2:G23:F3       0.0000      0.00000
T2:G3:F1        0.0000      0.00000
T2:G3:F2        0.0000      0.00000
T2:G3:F3        0.0000      0.00000
T2:G4:F1        0.0000      0.00000
T2:G4:F2        0.0000      0.00000
T2:G4:F3        0.0000      0.00000
T2:G5:F1        0.0000      0.00000
T2:G5:F2        0.0000      0.00000
T2:G5:F3        0.0000      0.00000
T2:G6:F1        0.0000      0.00000
T2:G6:F2        0.0000      0.00000
T2:G6:F3        0.0000      0.00000
T2:G7:F1        0.0000      0.00000
T2:G7:F2        0.0000      0.00000
T2:G7:F3        0.0000      0.00000
T2:G8:F1        0.0000      0.00000
T2:G8:F2        0.0000      0.00000
T2:G8:F3        0.0000      0.00000
T2:G9:F1        0.0000      0.00000
T2:G9:F2        0.0000      0.00000
T2:G9:F3        0.0000      0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(Y ~ R + T + R:T + G + G:T + R:T:G + F + F:T + F:G + F:G:T, ex7.3),
      type=3, singular.ok=TRUE) # NOT OK
```

```
Note: model has aliased coefficients
      sums of squares computed by model comparison


Anova Table (Type III tests)
```

```
Response: Y
            Sum Sq Df F values     Pr(>F)
R            0.000  0
T            0.000  0
G           73.444  2 116.6471 < 2.2e-16 ***
F          120.563  2 191.4828 < 2.2e-16 ***
R:T          0.000  0
T:G          5.778  2   9.1765 0.0006018 ***
T:F          0.822  2   1.3060 0.2834316
G:F         23.469 44   1.6943 0.0531910 .
R:T:G        8.778 12   2.3235 0.0253153 *
T:G:F       10.740 44   0.7753 0.7906401
Residuals   11.333 36
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.11 Example 8.1

(88) MODEL

```
ex8.1 = read.table("C:/G/Rt/Split/asbed.txt", header=TRUE)
ex8.1 = af(ex8.1, c("R", "A", "B"))
GLM(Y ~ R + A + R:A + B + B:R + A:B + A:B:R, ex8.1)
```

```
$ANOVA
Response : Y
                  Df Sum Sq Mean Sq F value Pr(>F)
MODEL            104 3951.8  37.999
RESIDUALS          0    0.0
CORRECTED TOTAL  104 3951.8

$`Type I`
      Df  Sum Sq Mean Sq F value Pr(>F)
R      2 1787.68  893.84
A     12  601.24   50.10
R:A    6   24.93    4.16
B      8  156.87   19.61
R:B    4  319.87   79.97
A:B   60 1012.26   16.87
R:A:B 12   49.00    4.08

$`Type II`
      Df  Sum Sq Mean Sq F value Pr(>F)
R      2  372.22 186.111
A     12  601.24  50.103
R:A    6   50.00   8.333
```

```
B       8  156.87  19.609
R:B     4   87.44  21.861
A:B    60 1012.26  16.871
R:A:B  12   49.00   4.083


$`Type III`
      Df  Sum Sq Mean Sq F value Pr(>F)
R      2  372.22 186.111
A     12  572.31  47.692
R:A    6   50.00   8.333
B      8  185.85  23.231
R:B    4   87.44  21.861
A:B   60 1012.26  16.871
R:A:B 12   49.00   4.083


$Parameter
           Estimate Std. Error t value Pr(>|t|)
(Intercept)      34
R1              -10
R2              -10
R3                0
A1              -19
A10             -24
A11             -20
A12             -19
A13             -20
A2              -20
A3              -19
A4              -16
A5              -16
A6              -12
A7              -20
A8               11
A9                0
R1:A1             0
R1:A10            5
R1:A11            0
R1:A12            0
R1:A13            0
R1:A2             0
R1:A3             0
R1:A4             0
R1:A5             0
R1:A6             0
R1:A7             0
R1:A8             0
R1:A9             0
R2:A1             0
```

```
R2:A10           5
R2:A11           0
R2:A12           0
R2:A13           0
R2:A2            0
R2:A3            0
R2:A4            0
R2:A5            0
R2:A6            0
R2:A7            0
R2:A8            0
R2:A9            0
R3:A1            0
R3:A10           0
R3:A11           0
R3:A12           0
R3:A13           0
R3:A2            0
R3:A3            0
R3:A4            0
R3:A5            0
R3:A6            0
R3:A7            0
R3:A8            0
R3:A9            0
B1               4
B2              -3
B3              -3
B4              -5
B5             -15
B6             -17
B7             -21
B8              -9
B9               0
R1:B1            0
R1:B2            0
R1:B3            0
R1:B4            0
R1:B5            0
R1:B6            0
R1:B7            0
R1:B8            0
R1:B9            0
R2:B1            0
R2:B2            0
R2:B3            0
R2:B4            0
R2:B5            0
```

R2:B6	0
R2:B7	10
R2:B8	0
R2:B9	0
R3:B1	0
R3:B2	0
R3:B3	0
R3:B4	0
R3:B5	0
R3:B6	0
R3:B7	0
R3:B8	0
R3:B9	0
A1:B1	0
A1:B2	0
A1:B3	0
A1:B4	0
A1:B5	0
A1:B6	0
A1:B7	24
A1:B8	11
A1:B9	0
A10:B1	0
A10:B2	−1
A10:B3	7
A10:B4	11
A10:B5	20
A10:B6	16
A10:B7	22
A10:B8	9
A10:B9	0
A11:B1	1
A11:B2	6
A11:B3	8
A11:B4	8
A11:B5	10
A11:B6	20
A11:B7	20
A11:B8	10
A11:B9	0
A12:B1	0
A12:B2	0
A12:B3	7
A12:B4	12
A12:B5	9
A12:B6	14
A12:B7	14
A12:B8	11

```
A12:B9              0
A13:B1              1
A13:B2              6
A13:B3              8
A13:B4              8
A13:B5             10
A13:B6             20
A13:B7             20
A13:B8             10
A13:B9              0
A2:B1               1
A2:B2               6
A2:B3               0
A2:B4               0
A2:B5               0
A2:B6               0
A2:B7              20
A2:B8              10
A2:B9               0
A3:B1               0
A3:B2               0
A3:B3               0
A3:B4               0
A3:B5               0
A3:B6               0
A3:B7              24
A3:B8              11
A3:B9               0
A4:B1               0
A4:B2               0
A4:B3               4
A4:B4               4
A4:B5               0
A4:B6               0
A4:B7              16
A4:B8               9
A4:B9               0
A5:B1               0
A5:B2               0
A5:B3               4
A5:B4               9
A5:B5               0
A5:B6               0
A5:B7              11
A5:B8               8
A5:B9               0
A6:B1               0
A6:B2               0
```

```
A6:B3               0
A6:B4               0
A6:B5               0
A6:B6               0
A6:B7              12
A6:B8               6
A6:B9               0
A7:B1               0
A7:B2               0
A7:B3               0
A7:B4               0
A7:B5              20
A7:B6              20
A7:B7              20
A7:B8              10
A7:B9               0
A8:B1               0
A8:B2               0
A8:B3               0
A8:B4               0
A8:B5             -11
A8:B6             -16
A8:B7              -6
A8:B8             -19
A8:B9               0
A9:B1               0
A9:B2               0
A9:B3               0
A9:B4               0
A9:B5               0
A9:B6               0
A9:B7               0
A9:B8               0
A9:B9               0
R1:A1:B1            0
R1:A1:B2            0
R1:A1:B3            0
R1:A1:B4            0
R1:A1:B5            0
R1:A1:B6            0
R1:A1:B7            0
R1:A1:B8            0
R1:A1:B9            0
R1:A10:B1           0
R1:A10:B2           0
R1:A10:B3           0
R1:A10:B4           0
R1:A10:B5           0
```

```
R1:A10:B6        0
R1:A10:B7        3
R1:A10:B8        2
R1:A10:B9        0
R1:A11:B1        0
R1:A11:B2        0
R1:A11:B3        0
R1:A11:B4        0
R1:A11:B5        0
R1:A11:B6        0
R1:A11:B7        0
R1:A11:B8        0
R1:A11:B9        0
R1:A12:B1        0
R1:A12:B2        0
R1:A12:B3        0
R1:A12:B4        0
R1:A12:B5        0
R1:A12:B6        0
R1:A12:B7        10
R1:A12:B8        0
R1:A12:B9        0
R1:A13:B1        0
R1:A13:B2        0
R1:A13:B3        0
R1:A13:B4        0
R1:A13:B5        0
R1:A13:B6        0
R1:A13:B7        0
R1:A13:B8        0
R1:A13:B9        0
R1:A2:B1         0
R1:A2:B2         0
R1:A2:B3         0
R1:A2:B4         0
R1:A2:B5         0
R1:A2:B6         0
R1:A2:B7         0
R1:A2:B8         0
R1:A2:B9         0
R1:A3:B1         0
R1:A3:B2         0
R1:A3:B3         0
R1:A3:B4         0
R1:A3:B5         0
R1:A3:B6         0
R1:A3:B7         0
R1:A3:B8         0
```

```
R1:A3:B9          0
R1:A4:B1          0
R1:A4:B2          0
R1:A4:B3          0
R1:A4:B4          0
R1:A4:B5          0
R1:A4:B6          0
R1:A4:B7          0
R1:A4:B8          0
R1:A4:B9          0
R1:A5:B1          0
R1:A5:B2          0
R1:A5:B3          0
R1:A5:B4          0
R1:A5:B5          0
R1:A5:B6          0
R1:A5:B7          0
R1:A5:B8          0
R1:A5:B9          0
R1:A6:B1          0
R1:A6:B2          0
R1:A6:B3          0
R1:A6:B4          0
R1:A6:B5          0
R1:A6:B6          0
R1:A6:B7          0
R1:A6:B8          0
R1:A6:B9          0
R1:A7:B1          0
R1:A7:B2          0
R1:A7:B3          0
R1:A7:B4          0
R1:A7:B5          0
R1:A7:B6          0
R1:A7:B7          0
R1:A7:B8          0
R1:A7:B9          0
R1:A8:B1          0
R1:A8:B2          0
R1:A8:B3          0
R1:A8:B4          0
R1:A8:B5          0
R1:A8:B6          0
R1:A8:B7          0
R1:A8:B8          0
R1:A8:B9          0
R1:A9:B1          0
R1:A9:B2          0
```

```
R1:A9:B3           0
R1:A9:B4           0
R1:A9:B5           0
R1:A9:B6           0
R1:A9:B7           0
R1:A9:B8           0
R1:A9:B9           0
R2:A1:B1           0
R2:A1:B2           0
R2:A1:B3           0
R2:A1:B4           0
R2:A1:B5           0
R2:A1:B6           0
R2:A1:B7           0
R2:A1:B8           0
R2:A1:B9           0
R2:A10:B1          0
R2:A10:B2          0
R2:A10:B3          0
R2:A10:B4          0
R2:A10:B5          0
R2:A10:B6          0
R2:A10:B7         -7
R2:A10:B8          2
R2:A10:B9          0
R2:A11:B1          0
R2:A11:B2          0
R2:A11:B3          0
R2:A11:B4          0
R2:A11:B5          0
R2:A11:B6          0
R2:A11:B7          0
R2:A11:B8          0
R2:A11:B9          0
R2:A12:B1          0
R2:A12:B2          0
R2:A12:B3          0
R2:A12:B4          0
R2:A12:B5          0
R2:A12:B6          0
R2:A12:B7          0
R2:A12:B8          0
R2:A12:B9          0
R2:A13:B1          0
R2:A13:B2          0
R2:A13:B3          0
R2:A13:B4          0
R2:A13:B5          0
```

```
R2:A13:B6          0
R2:A13:B7          0
R2:A13:B8          0
R2:A13:B9          0
R2:A2:B1           0
R2:A2:B2           0
R2:A2:B3           0
R2:A2:B4           0
R2:A2:B5           0
R2:A2:B6           0
R2:A2:B7           0
R2:A2:B8           0
R2:A2:B9           0
R2:A3:B1           0
R2:A3:B2           0
R2:A3:B3           0
R2:A3:B4           0
R2:A3:B5           0
R2:A3:B6           0
R2:A3:B7           0
R2:A3:B8           0
R2:A3:B9           0
R2:A4:B1           0
R2:A4:B2           0
R2:A4:B3           0
R2:A4:B4           0
R2:A4:B5           0
R2:A4:B6           0
R2:A4:B7           0
R2:A4:B8           0
R2:A4:B9           0
R2:A5:B1           0
R2:A5:B2           0
R2:A5:B3           0
R2:A5:B4           0
R2:A5:B5           0
R2:A5:B6           0
R2:A5:B7           0
R2:A5:B8           0
R2:A5:B9           0
R2:A6:B1           0
R2:A6:B2           0
R2:A6:B3           0
R2:A6:B4           0
R2:A6:B5           0
R2:A6:B6           0
R2:A6:B7           0
R2:A6:B8           0
```

```
R2:A6:B9          0
R2:A7:B1          0
R2:A7:B2          0
R2:A7:B3          0
R2:A7:B4          0
R2:A7:B5          0
R2:A7:B6          0
R2:A7:B7          0
R2:A7:B8          0
R2:A7:B9          0
R2:A8:B1          0
R2:A8:B2          0
R2:A8:B3          0
R2:A8:B4          0
R2:A8:B5          0
R2:A8:B6          0
R2:A8:B7          0
R2:A8:B8          0
R2:A8:B9          0
R2:A9:B1          0
R2:A9:B2          0
R2:A9:B3          0
R2:A9:B4          0
R2:A9:B5          0
R2:A9:B6          0
R2:A9:B7          0
R2:A9:B8          0
R2:A9:B9          0
R3:A1:B1          0
R3:A1:B2          0
R3:A1:B3          0
R3:A1:B4          0
R3:A1:B5          0
R3:A1:B6          0
R3:A1:B7          0
R3:A1:B8          0
R3:A1:B9          0
R3:A10:B1         0
R3:A10:B2         0
R3:A10:B3         0
R3:A10:B4         0
R3:A10:B5         0
R3:A10:B6         0
R3:A10:B7         0
R3:A10:B8         0
R3:A10:B9         0
R3:A11:B1         0
R3:A11:B2         0
```

```
R3:A11:B3        0
R3:A11:B4        0
R3:A11:B5        0
R3:A11:B6        0
R3:A11:B7        0
R3:A11:B8        0
R3:A11:B9        0
R3:A12:B1        0
R3:A12:B2        0
R3:A12:B3        0
R3:A12:B4        0
R3:A12:B5        0
R3:A12:B6        0
R3:A12:B7        0
R3:A12:B8        0
R3:A12:B9        0
R3:A13:B1        0
R3:A13:B2        0
R3:A13:B3        0
R3:A13:B4        0
R3:A13:B5        0
R3:A13:B6        0
R3:A13:B7        0
R3:A13:B8        0
R3:A13:B9        0
R3:A2:B1         0
R3:A2:B2         0
R3:A2:B3         0
R3:A2:B4         0
R3:A2:B5         0
R3:A2:B6         0
R3:A2:B7         0
R3:A2:B8         0
R3:A2:B9         0
R3:A3:B1         0
R3:A3:B2         0
R3:A3:B3         0
R3:A3:B4         0
R3:A3:B5         0
R3:A3:B6         0
R3:A3:B7         0
R3:A3:B8         0
R3:A3:B9         0
R3:A4:B1         0
R3:A4:B2         0
R3:A4:B3         0
R3:A4:B4         0
R3:A4:B5         0
```

```
R3:A4:B6          0
R3:A4:B7          0
R3:A4:B8          0
R3:A4:B9          0
R3:A5:B1          0
R3:A5:B2          0
R3:A5:B3          0
R3:A5:B4          0
R3:A5:B5          0
R3:A5:B6          0
R3:A5:B7          0
R3:A5:B8          0
R3:A5:B9          0
R3:A6:B1          0
R3:A6:B2          0
R3:A6:B3          0
R3:A6:B4          0
R3:A6:B5          0
R3:A6:B6          0
R3:A6:B7          0
R3:A6:B8          0
R3:A6:B9          0
R3:A7:B1          0
R3:A7:B2          0
R3:A7:B3          0
R3:A7:B4          0
R3:A7:B5          0
R3:A7:B6          0
R3:A7:B7          0
R3:A7:B8          0
R3:A7:B9          0
R3:A8:B1          0
R3:A8:B2          0
R3:A8:B3          0
R3:A8:B4          0
R3:A8:B5          0
R3:A8:B6          0
R3:A8:B7          0
R3:A8:B8          0
R3:A8:B9          0
R3:A9:B1          0
R3:A9:B2          0
R3:A9:B3          0
R3:A9:B4          0
R3:A9:B5          0
R3:A9:B6          0
R3:A9:B7          0
R3:A9:B8          0
```

```
R3:A9:B9            0
```

```
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(Y ~ R + A + R:A + B + B:R + A:B + A:B:R, ex8.1), type="III",
      singular.ok=TRUE) # NOT WORKING
```

7.12   Example 9.1

(89) MODEL

```
ex9.1 = read.table("C:/G/Rt/Split/Ex9.1-spex1.txt", header=TRUE)
ex9.1 = af(ex9.1, c("R", "A", "B"))
GLM(Y ~ R + A + R:A + B + A:B, ex9.1)
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value     Pr(>F)
MODEL           27 4920.8 182.251  10.594 5.927e-10 ***
RESIDUALS       34  584.9  17.203
CORRECTED TOTAL 61 5505.6
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
    Df Sum Sq Mean Sq F value     Pr(>F)
R    3  218.7   72.89  4.2369    0.01199 *
A    3  194.9   64.96  3.7760    0.01930 *
R:A  9  186.9   20.76  1.2070    0.32287
B    3 4087.4 1362.47 79.2018 1.998e-15 ***
A:B  9  233.0   25.88  1.5047    0.18602
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
    Df Sum Sq Mean Sq F value     Pr(>F)
R    3  157.8   52.61  3.0583    0.04134 *
A    3  227.2   75.73  4.4020    0.01014 *
R:A  9   94.5   10.50  0.6106    0.77932
B    3 4087.4 1362.47 79.2018 1.998e-15 ***
A:B  9  233.0   25.88  1.5047    0.18602
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
    Df Sum Sq Mean Sq F value     Pr(>F)
R    3  171.0   57.01  3.3138    0.03143 *
```

```
A     3  209.7    69.92  4.0643   0.01431 *
R:A   9   94.5    10.50  0.6106   0.77932
B     3 4089.9 1363.29 79.2493 1.998e-15 ***
A:B   9  233.0    25.88  1.5047   0.18602
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   70.167     4.1476 16.9175 < 2.2e-16 ***
R1             4.417     3.7862  1.1665   0.25152
R2             7.692     3.7862  2.0315   0.05008 .
R3             3.492     3.7862  0.9222   0.36292
R4             0.000     0.0000
A1             3.390     4.9728  0.6816   0.50009
A2            -7.679     4.9728 -1.5442   0.13179
A3            -1.235     4.9728 -0.2484   0.80529
A4             0.000     0.0000
R1:A1         -1.717     4.7892 -0.3584   0.72223
R1:A2         -1.042     4.7892 -0.2175   0.82912
R1:A3         -1.467     4.7892 -0.3062   0.76129
R1:A4          0.000     0.0000
R2:A1         -8.992     4.7892 -1.8775   0.06905 .
R2:A2         -2.817     4.7892 -0.5881   0.56033
R2:A3         -4.142     4.7892 -0.8648   0.39322
R2:A4          0.000     0.0000
R3:A1         -5.217     4.7892 -1.0893   0.28370
R3:A2         -3.292     4.7892 -0.6873   0.49655
R3:A3         -4.317     4.7892 -0.9013   0.37375
R3:A4          0.000     0.0000
R4:A1          0.000     0.0000
R4:A2          0.000     0.0000
R4:A3          0.000     0.0000
R4:A4          0.000     0.0000
B1            -3.517     3.2790 -1.0725   0.29105
B2           -18.817     3.2790 -5.7386 1.882e-06 ***
B3            -2.100     3.3865 -0.6201   0.53932
B4             0.000     0.0000
A1:B1          5.417     4.3992  1.2313   0.22666
A1:B2         -2.558     4.3992 -0.5815   0.56471
A1:B3          0.850     4.4799  0.1897   0.85064
A1:B4          0.000     0.0000
A2:B1         11.217     4.3992  2.5497   0.01546 *
A2:B2          5.567     4.3992  1.2654   0.21434
A2:B3          5.500     4.4799  1.2277   0.22799
A2:B4          0.000     0.0000
A3:B1          0.492     4.3992  0.1118   0.91167
A3:B2         -1.083     4.3992 -0.2463   0.80696
```

```
A3:B3          3.000      4.4799  0.6697    0.50760
A3:B4          0.000      0.0000
A4:B1          0.000      0.0000
A4:B2          0.000      0.0000
A4:B3          0.000      0.0000
A4:B4          0.000      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.13   Example 9.2

(90) MODEL

```
ex9.2 = read.table("C:/G/Rt/Split/Ex9.2-sbex.txt", header=TRUE)
ex9.2 = af(ex9.2, c("rep", "hyb", "gen"))
GLM(yield ~ rep + hyb + rep:hyb + gen + gen:rep + gen:hyb, ex9.2)
```

```
$ANOVA
Response : yield
                Df  Sum Sq Mean Sq F value    Pr(>F)
MODEL           40 247.813  6.1953  4.4606 0.001119 **
RESIDUALS       16  22.222  1.3889
CORRECTED TOTAL 56 270.035
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
        Df Sum Sq Mean Sq F value     Pr(>F)
rep      1  0.239  0.2388  0.1719 0.6839085
hyb      9 66.796  7.4218  5.3437 0.0018370 **
rep:hyb  8 67.000  8.3750  6.0300 0.0011569 **
gen      2 36.351 18.1754 13.0863 0.0004293 ***
rep:gen  2 16.923  8.4616  6.0924 0.0107858 *
hyb:gen 18 60.504  3.3613  2.4201 0.0408545 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
        Df Sum Sq Mean Sq F value     Pr(>F)
rep      1  0.167  0.1667  0.1200 0.7335481
hyb      9 66.796  7.4218  5.3437 0.0018370 **
rep:hyb  8 67.000  8.3750  6.0300 0.0011569 **
gen      2 36.351 18.1754 13.0863 0.0004293 ***
rep:gen  2 12.111  6.0556  4.3600 0.0308015 *
hyb:gen 18 60.504  3.3613  2.4201 0.0408545 *
---
```

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
         Df Sum Sq Mean Sq F value   Pr(>F)
rep   1 0.167 0.1667 0.1200 0.7335481
hyb   9 66.796 7.4218 5.3437 0.0018370 **
rep:hyb   8 67.000 8.3750 6.0300 0.0011569 **
gen   2 30.671 15.3356 11.0416 0.0009707 ***
rep:gen   2 12.111 6.0556 4.3600 0.0308015 *
hyb:gen 18 60.504 3.3613 2.4201 0.0408545 *

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   46.556   0.98862 47.0915 < 2.2e-16 ***
rep1   0.889   1.06381 0.8356 0.415699
rep2   0.000   0.00000
hyb0   -2.444   1.53826 -1.5891 0.131602
hyb1   2.667   1.36083 1.9596 0.067702 .
hyb2   1.000   1.36083 0.7348 0.473067
hyb3   -2.167   1.36083 -1.5922 0.130908
hyb4   1.000   1.36083 0.7348 0.473067
hyb5   -1.333   1.36083 -0.9798 0.341771
hyb6   1.500   1.36083 1.1023 0.286649
hyb7   4.500   1.36083 3.3068 0.004455 **
hyb8   -0.167   1.36083 -0.1225 0.904048
hyb9   0.000   0.00000
rep1:hyb0   0.000   0.00000
rep1:hyb1   -3.333   1.36083 -2.4495 0.026199 *
rep1:hyb2   -4.000   1.36083 -2.9394 0.009621 **
rep1:hyb3   0.333   1.36083 0.2449 0.809610
rep1:hyb4   0.000   1.36083 0.0000 1.000000
rep1:hyb5   2.667   1.36083 1.9596 0.067702 .
rep1:hyb6   -4.000   1.36083 -2.9394 0.009621 **
rep1:hyb7   -3.000   1.36083 -2.2045 0.042471 *
rep1:hyb8   -2.667   1.36083 -1.9596 0.067702 .
rep1:hyb9   0.000   0.00000
rep2:hyb0   0.000   0.00000
rep2:hyb1   0.000   0.00000
rep2:hyb2   0.000   0.00000
rep2:hyb3   0.000   0.00000
rep2:hyb4   0.000   0.00000
rep2:hyb5   0.000   0.00000
rep2:hyb6   0.000   0.00000
rep2:hyb7   0.000   0.00000
rep2:hyb8   0.000   0.00000
rep2:hyb9   0.000   0.00000

```
gen1            -3.056    1.24226 -2.4597  0.025671 *
gen2            -0.611    1.24226 -0.4919  0.629446
gen3             0.000    0.00000
rep1:gen1        2.111    0.78567  2.6870  0.016197 *
rep1:gen2        0.222    0.78567  0.2828  0.780924
rep1:gen3        0.000    0.00000
rep2:gen1        0.000    0.00000
rep2:gen2        0.000    0.00000
rep2:gen3        0.000    0.00000
hyb0:gen1        3.944    2.07870  1.8976  0.075951 .
hyb0:gen2        0.389    2.07870  0.1871  0.853947
hyb0:gen3        0.000    0.00000
hyb1:gen1       -3.000    1.66667 -1.8000  0.090743 .
hyb1:gen2       -4.000    1.66667 -2.4000  0.028919 *
hyb1:gen3        0.000    0.00000
hyb2:gen1        2.500    1.66667  1.5000  0.153088
hyb2:gen2       -2.500    1.66667 -1.5000  0.153088
hyb2:gen3        0.000    0.00000
hyb3:gen1        2.000    1.66667  1.2000  0.247607
hyb3:gen2       -0.500    1.66667 -0.3000  0.768040
hyb3:gen3        0.000    0.00000
hyb4:gen1       -2.000    1.66667 -1.2000  0.247607
hyb4:gen2       -1.000    1.66667 -0.6000  0.556909
hyb4:gen3        0.000    0.00000
hyb5:gen1        1.000    1.66667  0.6000  0.556909
hyb5:gen2        0.000    1.66667  0.0000  1.000000
hyb5:gen3        0.000    0.00000
hyb6:gen1       -1.000    1.66667 -0.6000  0.556909
hyb6:gen2       -0.500    1.66667 -0.3000  0.768040
hyb6:gen3        0.000    0.00000
hyb7:gen1       -0.500    1.66667 -0.3000  0.768040
hyb7:gen2       -2.000    1.66667 -1.2000  0.247607
hyb7:gen3        0.000    0.00000
hyb8:gen1        2.500    1.66667  1.5000  0.153088
hyb8:gen2       -2.000    1.66667 -1.2000  0.247607
hyb8:gen3        0.000    0.00000
hyb9:gen1        0.000    0.00000
hyb9:gen2        0.000    0.00000
hyb9:gen3        0.000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(yield ~ rep + hyb + rep:hyb + gen + gen:rep + gen:hyb, ex9.2), type=3,
      singular.ok=TRUE) # NOT OK
```

```
Note: model has aliased coefficients
```

```
        sums of squares computed by model comparison


Anova Table (Type III tests)

Response: yield
          Sum Sq Df F values     Pr(>F)
rep        0.000  0
hyb       66.704  8    6.0033 0.0011847 **
gen       30.671  2   11.0416 0.0009707 ***
rep:hyb   67.000  8    6.0300 0.0011569 **
rep:gen   12.111  2    4.3600 0.0308015 *
hyb:gen   60.504 18    2.4201 0.0408545 *
Residuals 22.222 16
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.14   Example 10.1

(91) MODEL

```
ex10.1 = read.table("C:/G/Rt/Split/Ex10.1-new.txt", header=TRUE)
ex10.1 = af(ex10.1, c("Site", "Block", "A", "B", "C"))
f10.1 = Yield ~ Site/Block + A/Site + B/Site + A:B + A:B:Site + A:B:Site:Block +
        C + A:C + B:C + A:B:C + C:Site + A:C:Site + B:C:Site + A:B:C:Site
GLM(f10.1, ex10.1)
```

```
$ANOVA
Response : Yield
                   Df      Sum Sq Mean Sq F value     Pr(>F)
MODEL             239 1639561484 6860090    2162 < 2.2e-16 ***
RESIDUALS         240     761522    3173
CORRECTED TOTAL   479 1640323006
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
               Df     Sum Sq   Mean Sq    F value Pr(>F)
Site            3     552717    184239 5.8064e+01 < 2e-16 ***
Site:Block      8    7062320    882790 2.7822e+02 < 2e-16 ***
A               4 1387680917 346920229 1.0933e+05 < 2e-16 ***
Site:A         12      34068      2839 8.9470e-01 0.55301
B               1  100939695 100939695 3.1812e+04 < 2e-16 ***
Site:B          3       1618       539 1.6990e-01 0.91662
A:B             4   31444008   7861002 2.4775e+03 < 2e-16 ***
Site:A:B       12      33737      2811 8.8600e-01 0.56185
Site:Block:A:B 72     186911      2596 8.1810e-01 0.84155
```

```
C                3    19356264    6452088 2.0334e+03 < 2e-16 ***
A:C             12    26075792    2172983 6.8483e+02 < 2e-16 ***
B:C              3    23901388    7967129 2.5109e+03 < 2e-16 ***
A:B:C           12    41996729    3499727 1.1030e+03 < 2e-16 ***
Site:C           9       47625       5292 1.6677e+00 0.09747 .
Site:A:C        36      104110       2892 9.1140e-01 0.61768
Site:B:C         9       61111       6790 2.1400e+00 0.02701 *
Site:A:B:C      36       82475       2291 7.2200e-01 0.87941
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
               Df      Sum Sq    Mean Sq    F value  Pr(>F)
Site             3      552717     184239 5.8064e+01 < 2e-16 ***
Site:Block       8     7062320     882790 2.7822e+02 < 2e-16 ***
A                4 1387680917  346920229 1.0933e+05 < 2e-16 ***
Site:A          12       34068       2839 8.9470e-01 0.55301
B                1   100939695  100939695 3.1812e+04 < 2e-16 ***
Site:B           3        1618        539 1.6990e-01 0.91662
A:B              4    31444008    7861002 2.4775e+03 < 2e-16 ***
Site:A:B        12       33737       2811 8.8600e-01 0.56185
Site:Block:A:B  72      186911       2596 8.1810e-01 0.84155
C                3    19356264    6452088 2.0334e+03 < 2e-16 ***
A:C             12    26075792    2172983 6.8483e+02 < 2e-16 ***
B:C              3    23901388    7967129 2.5109e+03 < 2e-16 ***
A:B:C           12    41996729    3499727 1.1030e+03 < 2e-16 ***
Site:C           9       47625       5292 1.6677e+00 0.09747 .
Site:A:C        36      104110       2892 9.1140e-01 0.61768
Site:B:C         9       61111       6790 2.1400e+00 0.02701 *
Site:A:B:C      36       82475       2291 7.2200e-01 0.87941
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
               Df      Sum Sq    Mean Sq    F value  Pr(>F)
Site             3      552717     184239 5.8064e+01 < 2e-16 ***
Site:Block       8     7062320     882790 2.7822e+02 < 2e-16 ***
A                4 1387680917  346920229 1.0933e+05 < 2e-16 ***
Site:A          12       34068       2839 8.9470e-01 0.55301
B                1   100939695  100939695 3.1812e+04 < 2e-16 ***
Site:B           3        1618        539 1.6990e-01 0.91662
A:B              4    31444008    7861002 2.4775e+03 < 2e-16 ***
Site:A:B        12       33737       2811 8.8600e-01 0.56185
Site:Block:A:B  72      186911       2596 8.1810e-01 0.84155
C                3    19356264    6452088 2.0334e+03 < 2e-16 ***
A:C             12    26075792    2172983 6.8483e+02 < 2e-16 ***
B:C              3    23901388    7967129 2.5109e+03 < 2e-16 ***
A:B:C           12    41996729    3499727 1.1030e+03 < 2e-16 ***
```

```
Site:C             9      47625      5292 1.6677e+00 0.09747 .
Site:A:C          36     104110      2892 9.1140e-01 0.61768
Site:B:C           9      61111      6790 2.1400e+00 0.02701 *
Site:A:B:C        36      82475      2291 7.2200e-01 0.87941
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
                     Estimate Std. Error   t value  Pr(>|t|)
(Intercept)           13608.3     39.831  341.6522 < 2.2e-16 ***
Site1                  -433.3     56.329   -7.6928 3.713e-13 ***
Site2                  -108.3     56.329   -1.9232  0.055637 .
Site3                  -116.7     56.329   -2.0711  0.039414 *
Site4                     0.0      0.000
Site1:BlockR1           175.0     39.831    4.3936 1.674e-05 ***
Site1:BlockR2           300.0     39.831    7.5318 1.013e-12 ***
Site1:BlockR3             0.0      0.000
Site2:BlockR1          -225.0     39.831   -5.6489 4.554e-08 ***
Site2:BlockR2          -375.0     39.831   -9.4148 < 2.2e-16 ***
Site2:BlockR3             0.0      0.000
Site3:BlockR1          -100.0     39.831   -2.5106  0.012711 *
Site3:BlockR2           -75.0     39.831   -1.8830  0.060916 .
Site3:BlockR3             0.0      0.000
Site4:BlockR1          -250.0     39.831   -6.2765 1.605e-09 ***
Site4:BlockR2          -275.0     39.831   -6.9042 4.483e-11 ***
Site4:BlockR3             0.0      0.000
AA1                   -5705.0     56.329 -101.2791 < 2.2e-16 ***
AA2                   -5020.2     56.329  -89.1230 < 2.2e-16 ***
AA3                   -3336.7     56.329  -59.2363 < 2.2e-16 ***
AA4                   -1241.7     56.329  -22.0429 < 2.2e-16 ***
AA5                       0.0      0.000
Site1:AA1                -2.4     79.662   -0.0303  0.975824
Site1:AA2                25.0     79.662    0.3138  0.753926
Site1:AA3               111.2     79.662    1.3965  0.163846
Site1:AA4               -16.7     79.662   -0.2092  0.834456
Site1:AA5                 0.0      0.000
Site2:AA1                91.2     79.662    1.1444  0.253590
Site2:AA2               132.4     79.662    1.6622  0.097771 .
Site2:AA3                30.7     79.662    0.3850  0.700608
Site2:AA4               -50.0     79.662   -0.6277  0.530828
Site2:AA5                 0.0      0.000
Site3:AA1                39.2     79.662    0.4917  0.623408
Site3:AA2                25.8     79.662    0.3243  0.746003
Site3:AA3               -38.3     79.662   -0.4802  0.631555
Site3:AA4               -41.7     79.662   -0.5230  0.601426
Site3:AA5                 0.0      0.000
Site4:AA1                 0.0      0.000
Site4:AA2                 0.0      0.000
```

```
Site4:AA3             0.0      0.000
Site4:AA4             0.0      0.000
Site4:AA5             0.0      0.000
BB1               -1300.0     56.329  -23.0785 < 2.2e-16 ***
BB2                  0.0      0.000
Site1:BB1          -16.7     79.662   -0.2092  0.834456
Site1:BB2            0.0      0.000
Site2:BB1          100.0     79.662    1.2553  0.210589
Site2:BB2            0.0      0.000
Site3:BB1            0.0     79.662    0.0000  1.000000
Site3:BB2            0.0      0.000
Site4:BB1            0.0      0.000
Site4:BB2            0.0      0.000
AA1:BB1          1438.0     79.662   18.0513 < 2.2e-16 ***
AA1:BB2             0.0      0.000
AA2:BB1          1746.3     79.662   21.9218 < 2.2e-16 ***
AA2:BB2             0.0      0.000
AA3:BB1          2470.3     79.662   31.0102 < 2.2e-16 ***
AA3:BB2             0.0      0.000
AA4:BB1           -68.1     79.662   -0.8547  0.393595
AA4:BB2             0.0      0.000
AA5:BB1             0.0      0.000
AA5:BB2             0.0      0.000
Site1:AA1:BB1      54.5    112.659    0.4838  0.628997
Site1:AA1:BB2       0.0      0.000
Site1:AA2:BB1     -20.4    112.659   -0.1812  0.856344
Site1:AA2:BB2       0.0      0.000
Site1:AA3:BB1    -141.2    112.659   -1.2530  0.211409
Site1:AA3:BB2       0.0      0.000
Site1:AA4:BB1      45.6    112.659    0.4046  0.686122
Site1:AA4:BB2       0.0      0.000
Site1:AA5:BB1       0.0      0.000
Site1:AA5:BB2       0.0      0.000
Site2:AA1:BB1     -90.0    112.659   -0.7989  0.425155
Site2:AA1:BB2       0.0      0.000
Site2:AA2:BB1    -140.2    112.659   -1.2442  0.214651
Site2:AA2:BB2       0.0      0.000
Site2:AA3:BB1     -60.0    112.659   -0.5326  0.594816
Site2:AA3:BB2       0.0      0.000
Site2:AA4:BB1       3.5    112.659    0.0311  0.975242
Site2:AA4:BB2       0.0      0.000
Site2:AA5:BB1       0.0      0.000
Site2:AA5:BB2       0.0      0.000
Site3:AA1:BB1      12.4    112.659    0.1102  0.912331
Site3:AA1:BB2       0.0      0.000
Site3:AA2:BB1      39.4    112.659    0.3499  0.726739
Site3:AA2:BB2       0.0      0.000
Site3:AA3:BB1      49.8    112.659    0.4423  0.658643
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```
Site3:AA3:BB2              0.0      0.000
Site3:AA4:BB1             32.7    112.659    0.2900   0.772097
Site3:AA4:BB2              0.0      0.000
Site3:AA5:BB1              0.0      0.000
Site3:AA5:BB2              0.0      0.000
Site4:AA1:BB1              0.0      0.000
Site4:AA1:BB2              0.0      0.000
Site4:AA2:BB1              0.0      0.000
Site4:AA2:BB2              0.0      0.000
Site4:AA3:BB1              0.0      0.000
Site4:AA3:BB2              0.0      0.000
Site4:AA4:BB1              0.0      0.000
Site4:AA4:BB2              0.0      0.000
Site4:AA5:BB1              0.0      0.000
Site4:AA5:BB2              0.0      0.000
Site1:BlockR1:AA1:BB1     15.5     56.329    0.2752   0.783425
Site1:BlockR1:AA1:BB2     -3.5     56.329   -0.0621   0.950507
Site1:BlockR1:AA2:BB1     70.2     56.329    1.2471   0.213567
Site1:BlockR1:AA2:BB2     50.0     56.329    0.8876   0.375626
Site1:BlockR1:AA3:BB1     10.0     56.329    0.1775   0.859244
Site1:BlockR1:AA3:BB2    -62.3     56.329   -1.1051   0.270221
Site1:BlockR1:AA4:BB1     50.5     56.329    0.8965   0.370878
Site1:BlockR1:AA4:BB2      0.0     56.329    0.0000   1.000000
Site1:BlockR1:AA5:BB1     50.0     56.329    0.8876   0.375626
Site1:BlockR1:AA5:BB2      0.0      0.000
Site1:BlockR2:AA1:BB1     17.2     56.329    0.3062   0.759692
Site1:BlockR2:AA1:BB2     53.7     56.329    0.9542   0.340939
Site1:BlockR2:AA2:BB1     61.7     56.329    1.0962   0.274077
Site1:BlockR2:AA2:BB2     77.7     56.329    1.3803   0.168787
Site1:BlockR2:AA3:BB1     29.0     56.329    0.5148   0.607147
Site1:BlockR2:AA3:BB2   -112.3     56.329   -1.9927   0.047423 *
Site1:BlockR2:AA4:BB1     42.0     56.329    0.7456   0.456631
Site1:BlockR2:AA4:BB2     75.0     56.329    1.3315   0.184303
Site1:BlockR2:AA5:BB1      0.0     56.329    0.0000   1.000000
Site1:BlockR2:AA5:BB2      0.0      0.000
Site1:BlockR3:AA1:BB1      0.0      0.000
Site1:BlockR3:AA1:BB2      0.0      0.000
Site1:BlockR3:AA2:BB1      0.0      0.000
Site1:BlockR3:AA2:BB2      0.0      0.000
Site1:BlockR3:AA3:BB1      0.0      0.000
Site1:BlockR3:AA3:BB2      0.0      0.000
Site1:BlockR3:AA4:BB1      0.0      0.000
Site1:BlockR3:AA4:BB2      0.0      0.000
Site1:BlockR3:AA5:BB1      0.0      0.000
Site1:BlockR3:AA5:BB2      0.0      0.000
Site2:BlockR1:AA1:BB1     35.7     56.329    0.6347   0.526255
Site2:BlockR1:AA1:BB2    -32.3     56.329   -0.5725   0.567503
Site2:BlockR1:AA2:BB1     68.5     56.329    1.2161   0.225157
```

```
Site2:BlockR1:AA2:BB2    -37.5    56.329    -0.6657    0.506225
Site2:BlockR1:AA3:BB1    -11.0    56.329    -0.1953    0.845339
Site2:BlockR1:AA3:BB2    -30.3    56.329    -0.5370    0.591752
Site2:BlockR1:AA4:BB1     46.2    56.329     0.8211    0.412426
Site2:BlockR1:AA4:BB2     25.0    56.329     0.4438    0.657574
Site2:BlockR1:AA5:BB1     50.0    56.329     0.8876    0.375626
Site2:BlockR1:AA5:BB2      0.0     0.000
Site2:BlockR2:AA1:BB1     56.7    56.329     1.0075    0.314726
Site2:BlockR2:AA1:BB2    -22.3    56.329    -0.3950    0.693196
Site2:BlockR2:AA2:BB1     32.5    56.329     0.5770    0.564505
Site2:BlockR2:AA2:BB2    -60.0    56.329    -1.0652    0.287873
Site2:BlockR2:AA3:BB1     -1.8    56.329    -0.0311    0.975242
Site2:BlockR2:AA3:BB2    -42.5    56.329    -0.7545    0.451295
Site2:BlockR2:AA4:BB1     22.5    56.329     0.3994    0.689927
Site2:BlockR2:AA4:BB2     50.0    56.329     0.8876    0.375626
Site2:BlockR2:AA5:BB1     50.0    56.329     0.8876    0.375626
Site2:BlockR2:AA5:BB2      0.0     0.000
Site2:BlockR3:AA1:BB1      0.0     0.000
Site2:BlockR3:AA1:BB2      0.0     0.000
Site2:BlockR3:AA2:BB1      0.0     0.000
Site2:BlockR3:AA2:BB2      0.0     0.000
Site2:BlockR3:AA3:BB1      0.0     0.000
Site2:BlockR3:AA3:BB2      0.0     0.000
Site2:BlockR3:AA4:BB1      0.0     0.000
Site2:BlockR3:AA4:BB2      0.0     0.000
Site2:BlockR3:AA5:BB1      0.0     0.000
Site2:BlockR3:AA5:BB2      0.0     0.000
Site3:BlockR1:AA1:BB1     17.2    56.329     0.3062    0.759692
Site3:BlockR1:AA1:BB2     -3.8    56.329    -0.0666    0.946977
Site3:BlockR1:AA2:BB1      4.2    56.329     0.0754    0.939920
Site3:BlockR1:AA2:BB2     -1.5    56.329    -0.0266    0.978778
Site3:BlockR1:AA3:BB1    -13.0    56.329    -0.2308    0.817678
Site3:BlockR1:AA3:BB2     50.0    56.329     0.8876    0.375626
Site3:BlockR1:AA4:BB1    -18.0    56.329    -0.3195    0.749589
Site3:BlockR1:AA4:BB2     25.0    56.329     0.4438    0.657574
Site3:BlockR1:AA5:BB1      0.0    56.329     0.0000    1.000000
Site3:BlockR1:AA5:BB2      0.0     0.000
Site3:BlockR2:AA1:BB1     21.0    56.329     0.3728    0.709621
Site3:BlockR2:AA1:BB2     15.2    56.329     0.2707    0.786832
Site3:BlockR2:AA2:BB1     -5.3    56.329    -0.0932    0.925821
Site3:BlockR2:AA2:BB2     15.7    56.329     0.2796    0.780021
Site3:BlockR2:AA3:BB1    -22.5    56.329    -0.3994    0.689927
Site3:BlockR2:AA3:BB2     75.0    56.329     1.3315    0.184303
Site3:BlockR2:AA4:BB1    -25.8    56.329    -0.4571    0.647990
Site3:BlockR2:AA4:BB2     25.0    56.329     0.4438    0.657574
Site3:BlockR2:AA5:BB1      0.0    56.329     0.0000    1.000000
Site3:BlockR2:AA5:BB2      0.0     0.000
Site3:BlockR3:AA1:BB1      0.0     0.000
```

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Site3:BlockR3:AA1:BB2        0.0       0.000
Site3:BlockR3:AA2:BB1        0.0       0.000
Site3:BlockR3:AA2:BB2        0.0       0.000
Site3:BlockR3:AA3:BB1        0.0       0.000
Site3:BlockR3:AA3:BB2        0.0       0.000
Site3:BlockR3:AA4:BB1        0.0       0.000
Site3:BlockR3:AA4:BB2        0.0       0.000
Site3:BlockR3:AA5:BB1        0.0       0.000
Site3:BlockR3:AA5:BB2        0.0       0.000
Site4:BlockR1:AA1:BB1       38.7      56.329    0.6879   0.492169
Site4:BlockR1:AA1:BB2        6.5      56.329    0.1154   0.908230
Site4:BlockR1:AA2:BB1       17.5      56.329    0.3107   0.756319
Site4:BlockR1:AA2:BB2      -13.0      56.329   -0.2308   0.817678
Site4:BlockR1:AA3:BB1       61.5      56.329    1.0918   0.276020
Site4:BlockR1:AA3:BB2      -32.3      56.329   -0.5725   0.567503
Site4:BlockR1:AA4:BB1       33.0      56.329    0.5858   0.558534
Site4:BlockR1:AA4:BB2       25.0      56.329    0.4438   0.657574
Site4:BlockR1:AA5:BB1       75.0      56.329    1.3315   0.184303
Site4:BlockR1:AA5:BB2        0.0       0.000
Site4:BlockR2:AA1:BB1      -69.8      56.329   -1.2383   0.216833
Site4:BlockR2:AA1:BB2      -36.5      56.329   -0.6480   0.517622
Site4:BlockR2:AA2:BB1      -53.8      56.329   -0.9542   0.340939
Site4:BlockR2:AA2:BB2      -14.3      56.329   -0.2530   0.800503
Site4:BlockR2:AA3:BB1      -62.3      56.329   -1.1051   0.270221
Site4:BlockR2:AA3:BB2     -104.5      56.329   -1.8552   0.064800  .
Site4:BlockR2:AA4:BB1       -3.8      56.329   -0.0666   0.946977
Site4:BlockR2:AA4:BB2        0.0      56.329    0.0000   1.000000
Site4:BlockR2:AA5:BB1       25.0      56.329    0.4438   0.657574
Site4:BlockR2:AA5:BB2        0.0       0.000
Site4:BlockR3:AA1:BB1        0.0       0.000
Site4:BlockR3:AA1:BB2        0.0       0.000
Site4:BlockR3:AA2:BB1        0.0       0.000
Site4:BlockR3:AA2:BB2        0.0       0.000
Site4:BlockR3:AA3:BB1        0.0       0.000
Site4:BlockR3:AA3:BB2        0.0       0.000
Site4:BlockR3:AA4:BB1        0.0       0.000
Site4:BlockR3:AA4:BB2        0.0       0.000
Site4:BlockR3:AA5:BB1        0.0       0.000
Site4:BlockR3:AA5:BB2        0.0       0.000
CC1                      -1066.7      45.993  -23.1920 < 2.2e-16 ***
CC2                       -733.3      45.993  -15.9445 < 2.2e-16 ***
CC3                       -533.3      45.993  -11.5960 < 2.2e-16 ***
CC4                          0.0       0.000
AA1:CC1                   1551.3      65.044   23.8506 < 2.2e-16 ***
AA1:CC2                    137.7      65.044    2.1165   0.035330 *
AA1:CC3                    201.0      65.044    3.0902   0.002236 **
AA1:CC4                      0.0       0.000
AA2:CC1                   1877.7      65.044   28.8678 < 2.2e-16 ***
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AA2:CC2                    1858.7      65.044    28.5757 < 2.2e-16 ***
AA2:CC3                    1936.7      65.044    29.7749 < 2.2e-16 ***
AA2:CC4                       0.0       0.000
AA3:CC1                    1915.7      65.044    29.4520 < 2.2e-16 ***
AA3:CC2                    1315.7      65.044    20.2274 < 2.2e-16 ***
AA3:CC3                     815.7      65.044    12.5403 < 2.2e-16 ***
AA3:CC4                       0.0       0.000
AA4:CC1                     -66.7      65.044    -1.0250   0.306418
AA4:CC2                    1200.0      65.044    18.4491 < 2.2e-16 ***
AA4:CC3                     833.3      65.044    12.8119 < 2.2e-16 ***
AA4:CC4                       0.0       0.000
AA5:CC1                       0.0       0.000
AA5:CC2                       0.0       0.000
AA5:CC3                       0.0       0.000
AA5:CC4                       0.0       0.000
BB1:CC1                     733.3      65.044    11.2745 < 2.2e-16 ***
BB1:CC2                     166.7      65.044     2.5624   0.011007 *
BB1:CC3                     200.0      65.044     3.0749   0.002350 **
BB1:CC4                       0.0       0.000
BB2:CC1                       0.0       0.000
BB2:CC2                       0.0       0.000
BB2:CC3                       0.0       0.000
BB2:CC4                       0.0       0.000
AA1:BB1:CC1               -2102.0      91.986   -22.8514 < 2.2e-16 ***
AA1:BB1:CC2               -122.3      91.986    -1.3299   0.184808
AA1:BB1:CC3               -116.7      91.986    -1.2683   0.205915
AA1:BB1:CC4                   0.0       0.000
AA1:BB2:CC1                   0.0       0.000
AA1:BB2:CC2                   0.0       0.000
AA1:BB2:CC3                   0.0       0.000
AA1:BB2:CC4                   0.0       0.000
AA2:BB1:CC1               -2365.3      91.986   -25.7142 < 2.2e-16 ***
AA2:BB1:CC2               -1887.7      91.986   -20.5213 < 2.2e-16 ***
AA2:BB1:CC3               -1849.3      91.986   -20.1046 < 2.2e-16 ***
AA2:BB1:CC4                   0.0       0.000
AA2:BB2:CC1                   0.0       0.000
AA2:BB2:CC2                   0.0       0.000
AA2:BB2:CC3                   0.0       0.000
AA2:BB2:CC4                   0.0       0.000
AA3:BB1:CC1               -4088.7      91.986   -44.4490 < 2.2e-16 ***
AA3:BB1:CC2               -2939.3      91.986   -31.9543 < 2.2e-16 ***
AA3:BB1:CC3               -2384.3      91.986   -25.9207 < 2.2e-16 ***
AA3:BB1:CC4                   0.0       0.000
AA3:BB2:CC1                   0.0       0.000
AA3:BB2:CC2                   0.0       0.000
AA3:BB2:CC3                   0.0       0.000
AA3:BB2:CC4                   0.0       0.000
AA4:BB1:CC1                -561.0      91.986    -6.0988 4.243e-09 ***
```

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AA4:BB1:CC2            -1233.3     91.986  -13.4079 < 2.2e-16 ***
AA4:BB1:CC3             -833.3     91.986   -9.0594 < 2.2e-16 ***
AA4:BB1:CC4                0.0      0.000
AA4:BB2:CC1                0.0      0.000
AA4:BB2:CC2                0.0      0.000
AA4:BB2:CC3                0.0      0.000
AA4:BB2:CC4                0.0      0.000
AA5:BB1:CC1                0.0      0.000
AA5:BB1:CC2                0.0      0.000
AA5:BB1:CC3                0.0      0.000
AA5:BB1:CC4                0.0      0.000
AA5:BB2:CC1                0.0      0.000
AA5:BB2:CC2                0.0      0.000
AA5:BB2:CC3                0.0      0.000
AA5:BB2:CC4                0.0      0.000
Site1:CC1                100.0     65.044    1.5374  0.125506
Site1:CC2                 33.3     65.044    0.5125  0.608789
Site1:CC3                  0.0     65.044    0.0000  1.000000
Site1:CC4                  0.0      0.000
Site2:CC1                133.3     65.044    2.0499  0.041461 *
Site2:CC2                133.3     65.044    2.0499  0.041461 *
Site2:CC3                 66.7     65.044    1.0250  0.306418
Site2:CC4                  0.0      0.000
Site3:CC1                 66.7     65.044    1.0250  0.306418
Site3:CC2                  0.0     65.044    0.0000  1.000000
Site3:CC3                  0.0     65.044    0.0000  1.000000
Site3:CC4                  0.0      0.000
Site4:CC1                  0.0      0.000
Site4:CC2                  0.0      0.000
Site4:CC3                  0.0      0.000
Site4:CC4                  0.0      0.000
Site1:AA1:CC1           -136.7     91.986   -1.4857  0.138660
Site1:AA1:CC2            -33.7     91.986   -0.3660  0.714688
Site1:AA1:CC3             39.0     91.986    0.4240  0.671961
Site1:AA1:CC4              0.0      0.000
Site1:AA2:CC1           -173.3     91.986   -1.8844  0.060726 .
Site1:AA2:CC2           -174.3     91.986   -1.8952  0.059265 .
Site1:AA2:CC3              0.7     91.986    0.0072  0.994223
Site1:AA2:CC4              0.0      0.000
Site1:AA3:CC1           -198.7     91.986   -2.1598  0.031782 *
Site1:AA3:CC2           -132.0     91.986   -1.4350  0.152587
Site1:AA3:CC3            -65.3     91.986   -0.7103  0.478235
Site1:AA3:CC4              0.0      0.000
Site1:AA4:CC1            -33.3     91.986   -0.3624  0.717390
Site1:AA4:CC2              0.0     91.986    0.0000  1.000000
Site1:AA4:CC3              0.0     91.986    0.0000  1.000000
Site1:AA4:CC4              0.0      0.000
Site1:AA5:CC1              0.0      0.000
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Site1:AA5:CC2           0.0      0.000
Site1:AA5:CC3           0.0      0.000
Site1:AA5:CC4           0.0      0.000
Site2:AA1:CC1        -180.3     91.986   -1.9605   0.051100 .
Site2:AA1:CC2         -81.3     91.986   -0.8842   0.377475
Site2:AA1:CC3         -47.0     91.986   -0.5109   0.609856
Site2:AA1:CC4           0.0      0.000
Site2:AA2:CC1        -196.7     91.986   -2.1380   0.033526 *
Site2:AA2:CC2        -179.3     91.986   -1.9496   0.052391 .
Site2:AA2:CC3        -124.7     91.986   -1.3553   0.176601
Site2:AA2:CC4           0.0      0.000
Site2:AA3:CC1         -85.3     91.986   -0.9277   0.354505
Site2:AA3:CC2         -85.3     91.986   -0.9277   0.354505
Site2:AA3:CC3         -52.0     91.986   -0.5653   0.572394
Site2:AA3:CC4           0.0      0.000
Site2:AA4:CC1         -33.3     91.986   -0.3624   0.717390
Site2:AA4:CC2           0.0     91.986    0.0000   1.000000
Site2:AA4:CC3          33.3     91.986    0.3624   0.717390
Site2:AA4:CC4           0.0      0.000
Site2:AA5:CC1           0.0      0.000
Site2:AA5:CC2           0.0      0.000
Site2:AA5:CC3           0.0      0.000
Site2:AA5:CC4           0.0      0.000
Site3:AA1:CC1        -138.7     91.986   -1.5075   0.133002
Site3:AA1:CC2         -83.0     91.986   -0.9023   0.367794
Site3:AA1:CC3        -104.0     91.986   -1.1306   0.259347
Site3:AA1:CC4           0.0      0.000
Site3:AA2:CC1         -61.7     91.986   -0.6704   0.503251
Site3:AA2:CC2         -71.7     91.986   -0.7791   0.436684
Site3:AA2:CC3         -68.0     91.986   -0.7392   0.460480
Site3:AA2:CC4           0.0      0.000
Site3:AA3:CC1        -115.7     91.986   -1.2574   0.209816
Site3:AA3:CC2         -15.7     91.986   -0.1703   0.864905
Site3:AA3:CC3         -15.7     91.986   -0.1703   0.864905
Site3:AA3:CC4           0.0      0.000
Site3:AA4:CC1          33.3     91.986    0.3624   0.717390
Site3:AA4:CC2           0.0     91.986    0.0000   1.000000
Site3:AA4:CC3          33.3     91.986    0.3624   0.717390
Site3:AA4:CC4           0.0      0.000
Site3:AA5:CC1           0.0      0.000
Site3:AA5:CC2           0.0      0.000
Site3:AA5:CC3           0.0      0.000
Site3:AA5:CC4           0.0      0.000
Site4:AA1:CC1           0.0      0.000
Site4:AA1:CC2           0.0      0.000
Site4:AA1:CC3           0.0      0.000
Site4:AA1:CC4           0.0      0.000
Site4:AA2:CC1           0.0      0.000
```

```
Site4:AA2:CC2              0.0       0.000
Site4:AA2:CC3              0.0       0.000
Site4:AA2:CC4              0.0       0.000
Site4:AA3:CC1              0.0       0.000
Site4:AA3:CC2              0.0       0.000
Site4:AA3:CC3              0.0       0.000
Site4:AA3:CC4              0.0       0.000
Site4:AA4:CC1              0.0       0.000
Site4:AA4:CC2              0.0       0.000
Site4:AA4:CC3              0.0       0.000
Site4:AA4:CC4              0.0       0.000
Site4:AA5:CC1              0.0       0.000
Site4:AA5:CC2              0.0       0.000
Site4:AA5:CC3              0.0       0.000
Site4:AA5:CC4              0.0       0.000
Site1:BB1:CC1              0.0      91.986     0.0000  1.000000
Site1:BB1:CC2             33.3      91.986     0.3624  0.717390
Site1:BB1:CC3             33.3      91.986     0.3624  0.717390
Site1:BB1:CC4              0.0       0.000
Site1:BB2:CC1              0.0       0.000
Site1:BB2:CC2              0.0       0.000
Site1:BB2:CC3              0.0       0.000
Site1:BB2:CC4              0.0       0.000
Site2:BB1:CC1           -166.7      91.986    -1.8119  0.071255 .
Site2:BB1:CC2           -200.0      91.986    -2.1743  0.030664 *
Site2:BB1:CC3           -233.3      91.986    -2.5366  0.011827 *
Site2:BB1:CC4              0.0       0.000
Site2:BB2:CC1              0.0       0.000
Site2:BB2:CC2              0.0       0.000
Site2:BB2:CC3              0.0       0.000
Site2:BB2:CC4              0.0       0.000
Site3:BB1:CC1             33.3      91.986     0.3624  0.717390
Site3:BB1:CC2             33.3      91.986     0.3624  0.717390
Site3:BB1:CC3            -66.7      91.986    -0.7248  0.469311
Site3:BB1:CC4              0.0       0.000
Site3:BB2:CC1              0.0       0.000
Site3:BB2:CC2              0.0       0.000
Site3:BB2:CC3              0.0       0.000
Site3:BB2:CC4              0.0       0.000
Site4:BB1:CC1              0.0       0.000
Site4:BB1:CC2              0.0       0.000
Site4:BB1:CC3              0.0       0.000
Site4:BB1:CC4              0.0       0.000
Site4:BB2:CC1              0.0       0.000
Site4:BB2:CC2              0.0       0.000
Site4:BB2:CC3              0.0       0.000
Site4:BB2:CC4              0.0       0.000
Site1:AA1:BB1:CC1         76.3     130.087     0.5868  0.557899
```

```
Site1:AA1:BB1:CC2    -48.0    130.087   -0.3690   0.712466
Site1:AA1:BB1:CC3   -105.3    130.087   -0.8097   0.418908
Site1:AA1:BB1:CC4      0.0      0.000
Site1:AA1:BB2:CC1      0.0      0.000
Site1:AA1:BB2:CC2      0.0      0.000
Site1:AA1:BB2:CC3      0.0      0.000
Site1:AA1:BB2:CC4      0.0      0.000
Site1:AA2:BB1:CC1     12.3    130.087    0.0948   0.924546
Site1:AA2:BB1:CC2    120.0    130.087    0.9225   0.357217
Site1:AA2:BB1:CC3    -23.7    130.087   -0.1819   0.855792
Site1:AA2:BB1:CC4      0.0      0.000
Site1:AA2:BB2:CC1      0.0      0.000
Site1:AA2:BB2:CC2      0.0      0.000
Site1:AA2:BB2:CC3      0.0      0.000
Site1:AA2:BB2:CC4      0.0      0.000
Site1:AA3:BB1:CC1    202.7    130.087    1.5579   0.120568
Site1:AA3:BB1:CC2    100.3    130.087    0.7713   0.441302
Site1:AA3:BB1:CC3     29.7    130.087    0.2281   0.819800
Site1:AA3:BB1:CC4      0.0      0.000
Site1:AA3:BB2:CC1      0.0      0.000
Site1:AA3:BB2:CC2      0.0      0.000
Site1:AA3:BB2:CC3      0.0      0.000
Site1:AA3:BB2:CC4      0.0      0.000
Site1:AA4:BB1:CC1    -13.7    130.087   -0.1051   0.916418
Site1:AA4:BB1:CC2    -70.0    130.087   -0.5381   0.591007
Site1:AA4:BB1:CC3    -66.7    130.087   -0.5125   0.608789
Site1:AA4:BB1:CC4      0.0      0.000
Site1:AA4:BB2:CC1      0.0      0.000
Site1:AA4:BB2:CC2      0.0      0.000
Site1:AA4:BB2:CC3      0.0      0.000
Site1:AA4:BB2:CC4      0.0      0.000
Site1:AA5:BB1:CC1      0.0      0.000
Site1:AA5:BB1:CC2      0.0      0.000
Site1:AA5:BB1:CC3      0.0      0.000
Site1:AA5:BB1:CC4      0.0      0.000
Site1:AA5:BB2:CC1      0.0      0.000
Site1:AA5:BB2:CC2      0.0      0.000
Site1:AA5:BB2:CC3      0.0      0.000
Site1:AA5:BB2:CC4      0.0      0.000
Site2:AA1:BB1:CC1    215.3    130.087    1.6553   0.099171 .
Site2:AA1:BB1:CC2     92.7    130.087    0.7123   0.476945
Site2:AA1:BB1:CC3    122.0    130.087    0.9378   0.349274
Site2:AA1:BB1:CC4      0.0      0.000
Site2:AA1:BB2:CC1      0.0      0.000
Site2:AA1:BB2:CC2      0.0      0.000
Site2:AA1:BB2:CC3      0.0      0.000
Site2:AA1:BB2:CC4      0.0      0.000
Site2:AA2:BB1:CC1    143.0    130.087    1.0993   0.272755
```

```
Site2:AA2:BB1:CC2     186.0    130.087     1.4298   0.154072
Site2:AA2:BB1:CC3     288.7    130.087     2.2190   0.027421 *
Site2:AA2:BB1:CC4       0.0      0.000
Site2:AA2:BB2:CC1       0.0      0.000
Site2:AA2:BB2:CC2       0.0      0.000
Site2:AA2:BB2:CC3       0.0      0.000
Site2:AA2:BB2:CC4       0.0      0.000
Site2:AA3:BB1:CC1     195.7    130.087     1.5041   0.133866
Site2:AA3:BB1:CC2     143.0    130.087     1.0993   0.272755
Site2:AA3:BB1:CC3     203.3    130.087     1.5631   0.119358
Site2:AA3:BB1:CC4       0.0      0.000
Site2:AA3:BB2:CC1       0.0      0.000
Site2:AA3:BB2:CC2       0.0      0.000
Site2:AA3:BB2:CC3       0.0      0.000
Site2:AA3:BB2:CC4       0.0      0.000
Site2:AA4:BB1:CC1     136.3    130.087     1.0480   0.295686
Site2:AA4:BB1:CC2      59.0    130.087     0.4535   0.650569
Site2:AA4:BB1:CC3      66.7    130.087     0.5125   0.608789
Site2:AA4:BB1:CC4       0.0      0.000
Site2:AA4:BB2:CC1       0.0      0.000
Site2:AA4:BB2:CC2       0.0      0.000
Site2:AA4:BB2:CC3       0.0      0.000
Site2:AA4:BB2:CC4       0.0      0.000
Site2:AA5:BB1:CC1       0.0      0.000
Site2:AA5:BB1:CC2       0.0      0.000
Site2:AA5:BB1:CC3       0.0      0.000
Site2:AA5:BB1:CC4       0.0      0.000
Site2:AA5:BB2:CC1       0.0      0.000
Site2:AA5:BB2:CC2       0.0      0.000
Site2:AA5:BB2:CC3       0.0      0.000
Site2:AA5:BB2:CC4       0.0      0.000
Site3:AA1:BB1:CC1      42.0    130.087     0.3229   0.747082
Site3:AA1:BB1:CC2     -74.0    130.087    -0.5688   0.569991
Site3:AA1:BB1:CC3      96.3    130.087     0.7405   0.459703
Site3:AA1:BB1:CC4       0.0      0.000
Site3:AA1:BB2:CC1       0.0      0.000
Site3:AA1:BB2:CC2       0.0      0.000
Site3:AA1:BB2:CC3       0.0      0.000
Site3:AA1:BB2:CC4       0.0      0.000
Site3:AA2:BB1:CC1    -113.3    130.087    -0.8712   0.384510
Site3:AA2:BB1:CC2       9.0    130.087     0.0692   0.944901
Site3:AA2:BB1:CC3      83.7    130.087     0.6432   0.520736
Site3:AA2:BB1:CC4       0.0      0.000
Site3:AA2:BB2:CC1       0.0      0.000
Site3:AA2:BB2:CC2       0.0      0.000
Site3:AA2:BB2:CC3       0.0      0.000
Site3:AA2:BB2:CC4       0.0      0.000
Site3:AA3:BB1:CC1      36.3    130.087     0.2793   0.780255
```

```
Site3:AA3:BB1:CC2        -46.7      130.087    -0.3587   0.720110
Site3:AA3:BB1:CC3         82.0      130.087     0.6303   0.529068
Site3:AA3:BB1:CC4          0.0        0.000
Site3:AA3:BB2:CC1          0.0        0.000
Site3:AA3:BB2:CC2          0.0        0.000
Site3:AA3:BB2:CC3          0.0        0.000
Site3:AA3:BB2:CC4          0.0        0.000
Site3:AA4:BB1:CC1        -89.0      130.087    -0.6842   0.494537
Site3:AA4:BB1:CC2       -100.0      130.087    -0.7687   0.442819
Site3:AA4:BB1:CC3         33.3      130.087     0.2562   0.797986
Site3:AA4:BB1:CC4          0.0        0.000
Site3:AA4:BB2:CC1          0.0        0.000
Site3:AA4:BB2:CC2          0.0        0.000
Site3:AA4:BB2:CC3          0.0        0.000
Site3:AA4:BB2:CC4          0.0        0.000
Site3:AA5:BB1:CC1          0.0        0.000
Site3:AA5:BB1:CC2          0.0        0.000
Site3:AA5:BB1:CC3          0.0        0.000
Site3:AA5:BB1:CC4          0.0        0.000
Site3:AA5:BB2:CC1          0.0        0.000
Site3:AA5:BB2:CC2          0.0        0.000
Site3:AA5:BB2:CC3          0.0        0.000
Site3:AA5:BB2:CC4          0.0        0.000
Site4:AA1:BB1:CC1          0.0        0.000
Site4:AA1:BB1:CC2          0.0        0.000
Site4:AA1:BB1:CC3          0.0        0.000
Site4:AA1:BB1:CC4          0.0        0.000
Site4:AA1:BB2:CC1          0.0        0.000
Site4:AA1:BB2:CC2          0.0        0.000
Site4:AA1:BB2:CC3          0.0        0.000
Site4:AA1:BB2:CC4          0.0        0.000
Site4:AA2:BB1:CC1          0.0        0.000
Site4:AA2:BB1:CC2          0.0        0.000
Site4:AA2:BB1:CC3          0.0        0.000
Site4:AA2:BB1:CC4          0.0        0.000
Site4:AA2:BB2:CC1          0.0        0.000
Site4:AA2:BB2:CC2          0.0        0.000
Site4:AA2:BB2:CC3          0.0        0.000
Site4:AA2:BB2:CC4          0.0        0.000
Site4:AA3:BB1:CC1          0.0        0.000
Site4:AA3:BB1:CC2          0.0        0.000
Site4:AA3:BB1:CC3          0.0        0.000
Site4:AA3:BB1:CC4          0.0        0.000
Site4:AA3:BB2:CC1          0.0        0.000
Site4:AA3:BB2:CC2          0.0        0.000
Site4:AA3:BB2:CC3          0.0        0.000
Site4:AA3:BB2:CC4          0.0        0.000
Site4:AA4:BB1:CC1          0.0        0.000
```

```
Site4:AA4:BB1:CC2          0.0      0.000
Site4:AA4:BB1:CC3          0.0      0.000
Site4:AA4:BB1:CC4          0.0      0.000
Site4:AA4:BB2:CC1          0.0      0.000
Site4:AA4:BB2:CC2          0.0      0.000
Site4:AA4:BB2:CC3          0.0      0.000
Site4:AA4:BB2:CC4          0.0      0.000
Site4:AA5:BB1:CC1          0.0      0.000
Site4:AA5:BB1:CC2          0.0      0.000
Site4:AA5:BB1:CC3          0.0      0.000
Site4:AA5:BB1:CC4          0.0      0.000
Site4:AA5:BB2:CC1          0.0      0.000
Site4:AA5:BB2:CC2          0.0      0.000
Site4:AA5:BB2:CC3          0.0      0.000
Site4:AA5:BB2:CC4          0.0      0.000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(f10.1, ex10.1), type=3, singular.ok=TRUE) # NOT OK for Site:Block
```

```
Note: model has aliased coefficients
      sums of squares computed by model comparison


Anova Table (Type III tests)

Response: Yield
                   Sum Sq  Df   F values   Pr(>F)
Site               552717   3 5.8064e+01  < 2e-16 ***
A              1387680917   4 1.0933e+05  < 2e-16 ***
B               100939695   1 3.1812e+04  < 2e-16 ***
C                19356264   3 2.0334e+03  < 2e-16 ***
Site:Block              0   0
Site:A              34068  12 8.9470e-01  0.55301
Site:B               1618   3 1.6990e-01  0.91662
A:B              31444008   4 2.4775e+03  < 2e-16 ***
A:C              26075792  12 6.8483e+02  < 2e-16 ***
B:C              23901388   3 2.5109e+03  < 2e-16 ***
Site:C              47625   9 1.6677e+00  0.09747 .
Site:A:B            33737  12 8.8600e-01  0.56185
A:B:C            41996729  12 1.1030e+03  < 2e-16 ***
Site:A:C           104110  36 9.1140e-01  0.61768
Site:B:C            61111   9 2.1400e+00  0.02701 *
Site:Block:A:B     186911  72 8.1810e-01  0.84155
Site:A:B:C          82475  36 7.2200e-01  0.87941
Residuals          761522 240
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.15 Example 10.2

(92) MODEL

```
ex10.2 = read.table("C:/G/Rt/Split/Ex10.2-spbsite.txt", header=TRUE)
ex10.2 = af(ex10.2, c("Site", "Block", "A", "B"))
GLM(Yield ~ Site + Site:Block + A + A:Site + A:Site:Block + B + B:Site +
            B:Site:Block + A:B + A:B:Site, ex10.2)
```

```
$ANOVA
Response : Yield
                Df      Sum Sq   Mean Sq F value     Pr(>F)
MODEL          227  6370995084 28066058    10814 < 2.2e-16 ***
RESIDUALS      252      654049     2595
CORRECTED TOTAL 479 6371649132
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
             Df      Sum Sq    Mean Sq    F value     Pr(>F)
Site          2   523573968  261786984 1.0086e+05 < 2.2e-16 ***
Site:Block    9  3756646710  417405190 1.6082e+05 < 2.2e-16 ***
A             4    29288163    7322041 2.8211e+03 < 2.2e-16 ***
Site:A        8      247899      30987 1.1939e+01 1.998e-14 ***
Site:Block:A 36     1783391      49539 1.9087e+01 < 2.2e-16 ***
B             7  1937592291  276798899 1.0665e+05 < 2.2e-16 ***
Site:B       14    15903698    1135978 4.3768e+02 < 2.2e-16 ***
Site:Block:B 63   105727288    1678211 6.4660e+02 < 2.2e-16 ***
A:B          28       91141       3255 1.2541e+00    0.1838
Site:A:B     56      140534       2510 9.6690e-01    0.5461
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
             Df      Sum Sq    Mean Sq    F value     Pr(>F)
Site          2   523573968  261786984 1.0086e+05 < 2.2e-16 ***
Site:Block    9  3756646710  417405190 1.6082e+05 < 2.2e-16 ***
A             4    29288163    7322041 2.8211e+03 < 2.2e-16 ***
Site:A        8      247899      30987 1.1939e+01 1.998e-14 ***
Site:Block:A 36     1783391      49539 1.9087e+01 < 2.2e-16 ***
B             7  1937592291  276798899 1.0665e+05 < 2.2e-16 ***
Site:B       14    15903698    1135978 4.3768e+02 < 2.2e-16 ***
Site:Block:B 63   105727288    1678211 6.4660e+02 < 2.2e-16 ***
A:B          28       91141       3255 1.2541e+00    0.1838
Site:A:B     56      140534       2510 9.6690e-01    0.5461
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
             Df      Sum Sq    Mean Sq    F value    Pr(>F)
Site          2    523573968  261786984  1.0086e+05  < 2.2e-16 ***
Site:Block    9   3756646710  417405190  1.6082e+05  < 2.2e-16 ***
A             4     29288163    7322041  2.8211e+03  < 2.2e-16 ***
Site:A        8       247899      30987  1.1939e+01  1.998e-14 ***
Site:Block:A 36      1783391      49539  1.9087e+01  < 2.2e-16 ***
B             7   1937592291  276798899  1.0665e+05  < 2.2e-16 ***
Site:B       14     15903698    1135978  4.3768e+02  < 2.2e-16 ***
Site:Block:B 63    105727288    1678211  6.4660e+02  < 2.2e-16 ***
A:B          28        91141       3255  1.2541e+00     0.1838
Site:A:B     56       140534       2510  9.6690e-01     0.5461
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
                 Estimate Std. Error   t value   Pr(>|t|)
(Intercept)       13975.4     35.112  398.0266  < 2.2e-16 ***
Site1             -3964.6     49.655  -79.8426  < 2.2e-16 ***
Site2             -6027.2     49.655 -121.3814  < 2.2e-16 ***
Site3                 0.0      0.000
Site1:BlockR1      5969.7     39.462  151.2767  < 2.2e-16 ***
Site1:BlockR2      3993.2     39.462  101.1914  < 2.2e-16 ***
Site1:BlockR3      7976.0     39.462  202.1185  < 2.2e-16 ***
Site1:BlockR4         0.0      0.000
Site2:BlockR1      1983.1     39.462   50.2533  < 2.2e-16 ***
Site2:BlockR2      8050.7     39.462  204.0115  < 2.2e-16 ***
Site2:BlockR3      9979.6     39.462  252.8913  < 2.2e-16 ***
Site2:BlockR4         0.0      0.000
Site3:BlockR1     -1977.8     39.462  -50.1183  < 2.2e-16 ***
Site3:BlockR2      4028.8     39.462  102.0941  < 2.2e-16 ***
Site3:BlockR3      6011.4     39.462  152.3335  < 2.2e-16 ***
Site3:BlockR4         0.0      0.000
AA1                -558.7     42.242  -13.2267  < 2.2e-16 ***
AA2                -438.8     42.242  -10.3889  < 2.2e-16 ***
AA3                -240.1     42.242   -5.6838  3.632e-08 ***
AA4                -153.3     42.242   -3.6279  0.0003458 ***
AA5                   0.0      0.000
Site1:AA1           -38.1     59.739   -0.6377  0.5242659
Site1:AA2             0.8     59.739    0.0131  0.9895761
Site1:AA3           -98.2     59.739   -1.6436  0.1015027
Site1:AA4           -21.4     59.739   -0.3583  0.7203955
Site1:AA5             0.0      0.000
Site2:AA1           413.1     59.739    6.9145  3.844e-11 ***
Site2:AA2           368.4     59.739    6.1670  2.752e-09 ***
Site2:AA3           138.4     59.739    2.3163  0.0213427 *
Site2:AA4           164.4     59.739    2.7516  0.0063618 **
```

```
Site2:AA5              0.0     0.000
Site3:AA1              0.0     0.000
Site3:AA2              0.0     0.000
Site3:AA3              0.0     0.000
Site3:AA4              0.0     0.000
Site3:AA5              0.0     0.000
Site1:BlockR1:AA1   -190.6    36.024   -5.2916 2.635e-07 ***
Site1:BlockR1:AA2   -131.1    36.024   -3.6400 0.0003308 ***
Site1:BlockR1:AA3    -76.1    36.024   -2.1132 0.0355682 *
Site1:BlockR1:AA4    -52.6    36.024   -1.4608 0.1453053
Site1:BlockR1:AA5      0.0     0.000
Site1:BlockR2:AA1   -188.1    36.024   -5.2222 3.702e-07 ***
Site1:BlockR2:AA2   -148.4    36.024   -4.1188 5.168e-05 ***
Site1:BlockR2:AA3    -43.6    36.024   -1.2110 0.2270282
Site1:BlockR2:AA4    -33.0    36.024   -0.9161 0.3605109
Site1:BlockR2:AA5      0.0     0.000
Site1:BlockR3:AA1   -234.0    36.024   -6.4957 4.379e-10 ***
Site1:BlockR3:AA2   -133.3    36.024   -3.6989 0.0002658 ***
Site1:BlockR3:AA3    -82.1    36.024   -2.2797 0.0234592 *
Site1:BlockR3:AA4    -87.8    36.024   -2.4359 0.0155490 *
Site1:BlockR3:AA5      0.0     0.000
Site1:BlockR4:AA1      0.0     0.000
Site1:BlockR4:AA2      0.0     0.000
Site1:BlockR4:AA3      0.0     0.000
Site1:BlockR4:AA4      0.0     0.000
Site1:BlockR4:AA5      0.0     0.000
Site2:BlockR1:AA1   -382.5    36.024  -10.6180 < 2.2e-16 ***
Site2:BlockR1:AA2   -261.9    36.024   -7.2695 4.528e-12 ***
Site2:BlockR1:AA3   -171.6    36.024   -4.7642 3.204e-06 ***
Site2:BlockR1:AA4    -74.5    36.024   -2.0681 0.0396533 *
Site2:BlockR1:AA5      0.0     0.000
Site2:BlockR2:AA1   -634.4    36.024  -17.6099 < 2.2e-16 ***
Site2:BlockR2:AA2   -508.7    36.024  -14.1226 < 2.2e-16 ***
Site2:BlockR2:AA3   -288.9    36.024   -8.0190 3.997e-14 ***
Site2:BlockR2:AA4   -183.6    36.024   -5.0973 6.768e-07 ***
Site2:BlockR2:AA5      0.0     0.000
Site2:BlockR3:AA1   -607.5    36.024  -16.8638 < 2.2e-16 ***
Site2:BlockR3:AA2   -466.6    36.024  -12.9532 < 2.2e-16 ***
Site2:BlockR3:AA3   -249.6    36.024   -6.9294 3.517e-11 ***
Site2:BlockR3:AA4   -166.4    36.024   -4.6185 6.169e-06 ***
Site2:BlockR3:AA5      0.0     0.000
Site2:BlockR4:AA1      0.0     0.000
Site2:BlockR4:AA2      0.0     0.000
Site2:BlockR4:AA3      0.0     0.000
Site2:BlockR4:AA4      0.0     0.000
Site2:BlockR4:AA5      0.0     0.000
Site3:BlockR1:AA1     11.6    36.024    0.3227 0.7471876
Site3:BlockR1:AA2    -27.1    36.024   -0.7530 0.4521683
```

```
Site3:BlockR1:AA3      -8.9    36.024   -0.2464 0.8056004
Site3:BlockR1:AA4      51.3    36.024    1.4227 0.1560685
Site3:BlockR1:AA5       0.0     0.000
Site3:BlockR2:AA1    -237.6    36.024   -6.5963 2.463e-10 ***
Site3:BlockR2:AA2    -200.2    36.024   -5.5588 6.907e-08 ***
Site3:BlockR2:AA3    -142.0    36.024   -3.9418 0.0001048 ***
Site3:BlockR2:AA4     -55.4    36.024   -1.5372 0.1255045
Site3:BlockR2:AA5       0.0     0.000
Site3:BlockR3:AA1    -207.1    36.024   -5.7497 2.578e-08 ***
Site3:BlockR3:AA2    -232.2    36.024   -6.4471 5.769e-10 ***
Site3:BlockR3:AA3    -127.7    36.024   -3.5463 0.0004657 ***
Site3:BlockR3:AA4     -66.9    36.024   -1.8564 0.0645621 .
Site3:BlockR3:AA5       0.0     0.000
Site3:BlockR4:AA1       0.0     0.000
Site3:BlockR4:AA2       0.0     0.000
Site3:BlockR4:AA3       0.0     0.000
Site3:BlockR4:AA4       0.0     0.000
Site3:BlockR4:AA5       0.0     0.000
BB1                 -5364.0    45.567 -117.7159 < 2.2e-16 ***
BB2                 -4564.7    45.567 -100.1746 < 2.2e-16 ***
BB3                 -3808.6    45.567  -83.5815 < 2.2e-16 ***
BB4                 -3070.7    45.567  -67.3877 < 2.2e-16 ***
BB5                 -2308.1    45.567  -50.6519 < 2.2e-16 ***
BB6                 -1561.6    45.567  -34.2694 < 2.2e-16 ***
BB7                  -704.7    45.567  -15.4641 < 2.2e-16 ***
BB8                     0.0     0.000
Site1:BB1             -87.2    64.441   -1.3539 0.1769672
Site1:BB2             -63.8    64.441   -0.9900 0.3231006
Site1:BB3             -48.9    64.441   -0.7588 0.4486638
Site1:BB4             -16.6    64.441   -0.2576 0.7969270
Site1:BB5              17.3    64.441    0.2677 0.7891606
Site1:BB6              16.3    64.441    0.2529 0.8005184
Site1:BB7            -127.0    64.441   -1.9716 0.0497538 *
Site1:BB8               0.0     0.000
Site2:BB1            3583.2    64.441   55.6033 < 2.2e-16 ***
Site2:BB2            3099.2    64.441   48.0926 < 2.2e-16 ***
Site2:BB3            2577.7    64.441   39.9999 < 2.2e-16 ***
Site2:BB4            2111.0    64.441   32.7585 < 2.2e-16 ***
Site2:BB5            1589.0    64.441   24.6581 < 2.2e-16 ***
Site2:BB6            1116.0    64.441   17.3173 < 2.2e-16 ***
Site2:BB7             555.1    64.441    8.6133 8.882e-16 ***
Site2:BB8               0.0     0.000
Site3:BB1               0.0     0.000
Site3:BB2               0.0     0.000
Site3:BB3               0.0     0.000
Site3:BB4               0.0     0.000
Site3:BB5               0.0     0.000
Site3:BB6               0.0     0.000
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273

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Site3:BB7              0.0       0.000
Site3:BB8              0.0       0.000
Site1:BlockR1:BB1  -1733.0      45.567  -38.0320 < 2.2e-16 ***
Site1:BlockR1:BB2  -1498.6      45.567  -32.8879 < 2.2e-16 ***
Site1:BlockR1:BB3  -1281.4      45.567  -28.1213 < 2.2e-16 ***
Site1:BlockR1:BB4   -984.4      45.567  -21.6034 < 2.2e-16 ***
Site1:BlockR1:BB5   -743.6      45.567  -16.3189 < 2.2e-16 ***
Site1:BlockR1:BB6   -499.4      45.567  -10.9597 < 2.2e-16 ***
Site1:BlockR1:BB7   -196.2      45.567   -4.3058 2.385e-05 ***
Site1:BlockR1:BB8      0.0       0.000
Site1:BlockR2:BB1  -1721.2      45.567  -37.7730 < 2.2e-16 ***
Site1:BlockR2:BB2  -1606.0      45.567  -35.2449 < 2.2e-16 ***
Site1:BlockR2:BB3  -1267.6      45.567  -27.8184 < 2.2e-16 ***
Site1:BlockR2:BB4  -1005.4      45.567  -22.0642 < 2.2e-16 ***
Site1:BlockR2:BB5   -800.4      45.567  -17.5654 < 2.2e-16 ***
Site1:BlockR2:BB6   -486.4      45.567  -10.6744 < 2.2e-16 ***
Site1:BlockR2:BB7   -233.8      45.567   -5.1309 5.761e-07 ***
Site1:BlockR2:BB8      0.0       0.000
Site1:BlockR3:BB1  -1709.0      45.567  -37.5053 < 2.2e-16 ***
Site1:BlockR3:BB2  -1522.6      45.567  -33.4146 < 2.2e-16 ***
Site1:BlockR3:BB3  -1220.2      45.567  -26.7782 < 2.2e-16 ***
Site1:BlockR3:BB4   -965.2      45.567  -21.1820 < 2.2e-16 ***
Site1:BlockR3:BB5   -767.8      45.567  -16.8499 < 2.2e-16 ***
Site1:BlockR3:BB6   -476.2      45.567  -10.4506 < 2.2e-16 ***
Site1:BlockR3:BB7   -220.2      45.567   -4.8325 2.345e-06 ***
Site1:BlockR3:BB8      0.0       0.000
Site1:BlockR4:BB1      0.0       0.000
Site1:BlockR4:BB2      0.0       0.000
Site1:BlockR4:BB3      0.0       0.000
Site1:BlockR4:BB4      0.0       0.000
Site1:BlockR4:BB5      0.0       0.000
Site1:BlockR4:BB6      0.0       0.000
Site1:BlockR4:BB7      0.0       0.000
Site1:BlockR4:BB8      0.0       0.000
Site2:BlockR1:BB1  -3519.6      45.567  -77.2402 < 2.2e-16 ***
Site2:BlockR1:BB2  -3097.8      45.567  -67.9835 < 2.2e-16 ***
Site2:BlockR1:BB3  -2563.0      45.567  -56.2469 < 2.2e-16 ***
Site2:BlockR1:BB4  -2044.0      45.567  -44.8571 < 2.2e-16 ***
Site2:BlockR1:BB5  -1539.6      45.567  -33.7877 < 2.2e-16 ***
Site2:BlockR1:BB6  -1052.8      45.567  -23.1045 < 2.2e-16 ***
Site2:BlockR1:BB7   -552.0      45.567  -12.1141 < 2.2e-16 ***
Site2:BlockR1:BB8      0.0       0.000
Site2:BlockR2:BB1  -5360.8      45.567 -117.6467 < 2.2e-16 ***
Site2:BlockR2:BB2  -4648.0      45.567 -102.0038 < 2.2e-16 ***
Site2:BlockR2:BB3  -3890.2      45.567  -85.3733 < 2.2e-16 ***
Site2:BlockR2:BB4  -3094.2      45.567  -67.9045 < 2.2e-16 ***
Site2:BlockR2:BB5  -2335.6      45.567  -51.2565 < 2.2e-16 ***
Site2:BlockR2:BB6  -1556.2      45.567  -34.1520 < 2.2e-16 ***
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Site2:BlockR2:BB7   -830.8    45.567  -18.2325 < 2.2e-16 ***
Site2:BlockR2:BB8      0.0     0.000
Site2:BlockR3:BB1  -5309.4    45.567 -116.5187 < 2.2e-16 ***
Site2:BlockR3:BB2  -4604.2    45.567 -101.0426 < 2.2e-16 ***
Site2:BlockR3:BB3  -3827.2    45.567  -83.9907 < 2.2e-16 ***
Site2:BlockR3:BB4  -3058.2    45.567  -67.1145 < 2.2e-16 ***
Site2:BlockR3:BB5  -2281.6    45.567  -50.0714 < 2.2e-16 ***
Site2:BlockR3:BB6  -1466.6    45.567  -32.1856 < 2.2e-16 ***
Site2:BlockR3:BB7   -795.8    45.567  -17.4644 < 2.2e-16 ***
Site2:BlockR3:BB8      0.0     0.000
Site2:BlockR4:BB1      0.0     0.000
Site2:BlockR4:BB2      0.0     0.000
Site2:BlockR4:BB3      0.0     0.000
Site2:BlockR4:BB4      0.0     0.000
Site2:BlockR4:BB5      0.0     0.000
Site2:BlockR4:BB6      0.0     0.000
Site2:BlockR4:BB7      0.0     0.000
Site2:BlockR4:BB8      0.0     0.000
Site3:BlockR1:BB1     -7.4    45.567   -0.1624 0.8711222
Site3:BlockR1:BB2     26.4    45.567    0.5794 0.5628587
Site3:BlockR1:BB3    -48.4    45.567   -1.0622 0.2891736
Site3:BlockR1:BB4    -67.6    45.567   -1.4835 0.1391827
Site3:BlockR1:BB5    -35.0    45.567   -0.7681 0.4431463
Site3:BlockR1:BB6     -8.2    45.567   -0.1800 0.8573324
Site3:BlockR1:BB7    -66.6    45.567   -1.4616 0.1451004
Site3:BlockR1:BB8      0.0     0.000
Site3:BlockR2:BB1  -1771.4    45.567  -38.8747 < 2.2e-16 ***
Site3:BlockR2:BB2  -1533.8    45.567  -33.6604 < 2.2e-16 ***
Site3:BlockR2:BB3  -1295.8    45.567  -28.4373 < 2.2e-16 ***
Site3:BlockR2:BB4  -1082.6    45.567  -23.7585 < 2.2e-16 ***
Site3:BlockR2:BB5   -796.0    45.567  -17.4688 < 2.2e-16 ***
Site3:BlockR2:BB6   -482.0    45.567  -10.5778 < 2.2e-16 ***
Site3:BlockR2:BB7   -304.2    45.567   -6.6759 1.556e-10 ***
Site3:BlockR2:BB8      0.0     0.000
Site3:BlockR3:BB1  -1772.4    45.567  -38.8966 < 2.2e-16 ***
Site3:BlockR3:BB2  -1509.0    45.567  -33.1161 < 2.2e-16 ***
Site3:BlockR3:BB3  -1281.6    45.567  -28.1257 < 2.2e-16 ***
Site3:BlockR3:BB4  -1013.2    45.567  -22.2354 < 2.2e-16 ***
Site3:BlockR3:BB5   -751.8    45.567  -16.4988 < 2.2e-16 ***
Site3:BlockR3:BB6   -462.6    45.567  -10.1521 < 2.2e-16 ***
Site3:BlockR3:BB7   -248.6    45.567   -5.4557 1.165e-07 ***
Site3:BlockR3:BB8      0.0     0.000
Site3:BlockR4:BB1      0.0     0.000
Site3:BlockR4:BB2      0.0     0.000
Site3:BlockR4:BB3      0.0     0.000
Site3:BlockR4:BB4      0.0     0.000
Site3:BlockR4:BB5      0.0     0.000
Site3:BlockR4:BB6      0.0     0.000
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Site3:BlockR4:BB7      0.0       0.000
Site3:BlockR4:BB8      0.0       0.000
AA1:BB1              -61.5      50.945    -1.2072 0.2284965
AA1:BB2             -140.0      50.945    -2.7480 0.0064285 **
AA1:BB3              -57.7      50.945    -1.1336 0.2580534
AA1:BB4              -29.2      50.945    -0.5741 0.5663822
AA1:BB5              -66.7      50.945    -1.3102 0.1913120
AA1:BB6              -41.5      50.945    -0.8146 0.4160716
AA1:BB7              -40.5      50.945    -0.7950 0.4273795
AA1:BB8                0.0       0.000
AA2:BB1              -32.5      50.945    -0.6379 0.5240931
AA2:BB2              -62.7      50.945    -1.2317 0.2192050
AA2:BB3              -59.0      50.945    -1.1581 0.2479183
AA2:BB4               51.8      50.945     1.0158 0.3107018
AA2:BB5                3.8      50.945     0.0736 0.9413805
AA2:BB6                8.3      50.945     0.1619 0.8714843
AA2:BB7                6.3      50.945     0.1227 0.9024579
AA2:BB8                0.0       0.000
AA3:BB1              -90.0      50.945    -1.7666 0.0785061 .
AA3:BB2             -122.7      50.945    -2.4094 0.0166946 *
AA3:BB3             -110.0      50.945    -2.1592 0.0317805 *
AA3:BB4              -63.0      50.945    -1.2366 0.2173799
AA3:BB5              -36.7      50.945    -0.7214 0.4713562
AA3:BB6              -11.5      50.945    -0.2257 0.8215928
AA3:BB7             -104.2      50.945    -2.0463 0.0417637 *
AA3:BB8                0.0       0.000
AA4:BB1              -66.2      50.945    -1.3004 0.1946476
AA4:BB2              -60.2      50.945    -1.1826 0.2380667
AA4:BB3               -7.5      50.945    -0.1472 0.8830788
AA4:BB4                3.8      50.945     0.0736 0.9413805
AA4:BB5               12.0      50.945     0.2355 0.8139760
AA4:BB6               14.5      50.945     0.2846 0.7761701
AA4:BB7              -37.2      50.945    -0.7312 0.4653514
AA4:BB8                0.0       0.000
AA5:BB1                0.0       0.000
AA5:BB2                0.0       0.000
AA5:BB3                0.0       0.000
AA5:BB4                0.0       0.000
AA5:BB5                0.0       0.000
AA5:BB6                0.0       0.000
AA5:BB7                0.0       0.000
AA5:BB8                0.0       0.000
Site1:AA1:BB1         67.2      72.048     0.9334 0.3515017
Site1:AA1:BB2        118.7      72.048     1.6482 0.1005547
Site1:AA1:BB3         49.7      72.048     0.6905 0.4905056
Site1:AA1:BB4        -13.0      72.048    -0.1804 0.8569552
Site1:AA1:BB5         77.7      72.048     1.0791 0.2815539
Site1:AA1:BB6         10.5      72.048     0.1457 0.8842456
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Site1:AA1:BB7      48.7      72.048      0.6766 0.4992577
Site1:AA1:BB8       0.0       0.000
Site1:AA2:BB1      47.5      72.048      0.6593 0.5103141
Site1:AA2:BB2      75.5      72.048      1.0479 0.2956805
Site1:AA2:BB3      35.2      72.048      0.4893 0.6250835
Site1:AA2:BB4     -56.8      72.048     -0.7877 0.4316280
Site1:AA2:BB5     -52.5      72.048     -0.7287 0.4668712
Site1:AA2:BB6     -57.3      72.048     -0.7946 0.4275862
Site1:AA2:BB7      -7.0      72.048     -0.0972 0.9226782
Site1:AA2:BB8       0.0       0.000
Site1:AA3:BB1     172.0      72.048      2.3873 0.0177101 *
Site1:AA3:BB2     116.0      72.048      1.6100 0.1086397
Site1:AA3:BB3     123.2      72.048      1.7107 0.0883720 .
Site1:AA3:BB4      21.0      72.048      0.2915 0.7709287
Site1:AA3:BB5      64.7      72.048      0.8987 0.3696645
Site1:AA3:BB6     -24.3      72.048     -0.3366 0.7367115
Site1:AA3:BB7     182.7      72.048      2.5365 0.0118006 *
Site1:AA3:BB8       0.0       0.000
Site1:AA4:BB1     104.5      72.048      1.4504 0.1481824
Site1:AA4:BB2      95.7      72.048      1.3290 0.1850560
Site1:AA4:BB3      73.2      72.048      1.0167 0.3102767
Site1:AA4:BB4       9.7      72.048      0.1353 0.8924613
Site1:AA4:BB5     -17.3      72.048     -0.2394 0.8109707
Site1:AA4:BB6     -30.5      72.048     -0.4233 0.6724148
Site1:AA4:BB7     141.7      72.048      1.9674 0.0502283 .
Site1:AA4:BB8       0.0       0.000
Site1:AA5:BB1       0.0       0.000
Site1:AA5:BB2       0.0       0.000
Site1:AA5:BB3       0.0       0.000
Site1:AA5:BB4       0.0       0.000
Site1:AA5:BB5       0.0       0.000
Site1:AA5:BB6       0.0       0.000
Site1:AA5:BB7       0.0       0.000
Site1:AA5:BB8       0.0       0.000
Site2:AA1:BB1     -11.8      72.048     -0.1631 0.8705810
Site2:AA1:BB2     106.7      72.048      1.4817 0.1396805
Site2:AA1:BB3       8.7      72.048      0.1214 0.9034334
Site2:AA1:BB4     -57.5      72.048     -0.7981 0.4255737
Site2:AA1:BB5      17.5      72.048      0.2429 0.8082844
Site2:AA1:BB6     -26.3      72.048     -0.3643 0.7159080
Site2:AA1:BB7     -30.0      72.048     -0.4164 0.6774782
Site2:AA1:BB8       0.0       0.000
Site2:AA2:BB1     -89.5      72.048     -1.2422 0.2153051
Site2:AA2:BB2     -74.3      72.048     -1.0306 0.3037314
Site2:AA2:BB3     -32.3      72.048     -0.4476 0.6548116
Site2:AA2:BB4    -151.8      72.048     -2.1062 0.0361722 *
Site2:AA2:BB5    -127.5      72.048     -1.7697 0.0779927 .
Site2:AA2:BB6    -163.5      72.048     -2.2693 0.0240938 *
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Site2:AA2:BB7       -127.5      72.048   -1.7697 0.0779927 .
Site2:AA2:BB8          0.0       0.000
Site2:AA3:BB1         57.7      72.048    0.8016 0.4235667
Site2:AA3:BB2         82.0      72.048    1.1381 0.2561446
Site2:AA3:BB3         95.2      72.048    1.3220 0.1873529
Site2:AA3:BB4        -32.0      72.048   -0.4442 0.6573149
Site2:AA3:BB5         60.2      72.048    0.8363 0.4038052
Site2:AA3:BB6        -45.0      72.048   -0.6246 0.5328074
Site2:AA3:BB7         69.7      72.048    0.9681 0.3339179
Site2:AA3:BB8          0.0       0.000
Site2:AA4:BB1        -22.3      72.048   -0.3088 0.7577110
Site2:AA4:BB2        -49.3      72.048   -0.6836 0.4948713
Site2:AA4:BB3         -4.0      72.048   -0.0555 0.9557691
Site2:AA4:BB4        -57.8      72.048   -0.8016 0.4235667
Site2:AA4:BB5        -81.3      72.048   -1.1277 0.2605082
Site2:AA4:BB6       -111.0      72.048   -1.5406 0.1246574
Site2:AA4:BB7        -65.5      72.048   -0.9091 0.3641550
Site2:AA4:BB8          0.0       0.000
Site2:AA5:BB1          0.0       0.000
Site2:AA5:BB2          0.0       0.000
Site2:AA5:BB3          0.0       0.000
Site2:AA5:BB4          0.0       0.000
Site2:AA5:BB5          0.0       0.000
Site2:AA5:BB6          0.0       0.000
Site2:AA5:BB7          0.0       0.000
Site2:AA5:BB8          0.0       0.000
Site3:AA1:BB1          0.0       0.000
Site3:AA1:BB2          0.0       0.000
Site3:AA1:BB3          0.0       0.000
Site3:AA1:BB4          0.0       0.000
Site3:AA1:BB5          0.0       0.000
Site3:AA1:BB6          0.0       0.000
Site3:AA1:BB7          0.0       0.000
Site3:AA1:BB8          0.0       0.000
Site3:AA2:BB1          0.0       0.000
Site3:AA2:BB2          0.0       0.000
Site3:AA2:BB3          0.0       0.000
Site3:AA2:BB4          0.0       0.000
Site3:AA2:BB5          0.0       0.000
Site3:AA2:BB6          0.0       0.000
Site3:AA2:BB7          0.0       0.000
Site3:AA2:BB8          0.0       0.000
Site3:AA3:BB1          0.0       0.000
Site3:AA3:BB2          0.0       0.000
Site3:AA3:BB3          0.0       0.000
Site3:AA3:BB4          0.0       0.000
Site3:AA3:BB5          0.0       0.000
Site3:AA3:BB6          0.0       0.000
```

```
Site3:AA3:BB7              0.0       0.000
Site3:AA3:BB8              0.0       0.000
Site3:AA4:BB1              0.0       0.000
Site3:AA4:BB2              0.0       0.000
Site3:AA4:BB3              0.0       0.000
Site3:AA4:BB4              0.0       0.000
Site3:AA4:BB5              0.0       0.000
Site3:AA4:BB6              0.0       0.000
Site3:AA4:BB7              0.0       0.000
Site3:AA4:BB8              0.0       0.000
Site3:AA5:BB1              0.0       0.000
Site3:AA5:BB2              0.0       0.000
Site3:AA5:BB3              0.0       0.000
Site3:AA5:BB4              0.0       0.000
Site3:AA5:BB5              0.0       0.000
Site3:AA5:BB6              0.0       0.000
Site3:AA5:BB7              0.0       0.000
Site3:AA5:BB8              0.0       0.000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.16 Example 11.1

(93) MODEL

```
ex11.1 = read.table("C:/G/Rt/Split/Ex11.1-cov.txt", header=TRUE)
ex11.1 = af(ex11.1, c("R", "T", "S"))
GLM(Y ~ R + T + R:T + S + S:T, ex11.1)
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value  Pr(>F)
MODEL           11    328 29.8182  3.1948 0.02875 *
RESIDUALS       12    112  9.3333
CORRECTED TOTAL 23    440
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
     Df Sum Sq Mean Sq F value  Pr(>F)
R     2     48      24  2.5714 0.11765
T     1     24      24  2.5714 0.13479
R:T   2     16       8  0.8571 0.44880
S     3    156      52  5.5714 0.01251 *
T:S   3     84      28  3.0000 0.07277 .
---
```

279

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
    Df Sum Sq Mean Sq F value  Pr(>F)
R    2    48      24  2.5714 0.11765
T    1    24      24  2.5714 0.13479
R:T  2    16       8  0.8571 0.44880
S    3   156      52  5.5714 0.01251 *
T:S  3    84      28  3.0000 0.07277 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
    Df Sum Sq Mean Sq F value  Pr(>F)
R    2    48      24  2.5714 0.11765
T    1    24      24  2.5714 0.13479
R:T  2    16       8  0.8571 0.44880
S    3   156      52  5.5714 0.01251 *
T:S  3    84      28  3.0000 0.07277 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)      17     2.1602  7.8695 4.448e-06 ***
R1               -5     2.1602 -2.3146 0.0391521 *
R2               -1     2.1602 -0.4629 0.6517110
R3                0     0.0000
T1              -10     3.0551 -3.2733 0.0066627 **
T2                0     0.0000
R1:T1             4     3.0551  1.3093 0.2149461
R1:T2             0     0.0000
R2:T1             2     3.0551  0.6547 0.5250404
R2:T2             0     0.0000
R3:T1             0     0.0000
R3:T2             0     0.0000
S1               -8     2.4944 -3.2071 0.0075321 **
S2               -9     2.4944 -3.6080 0.0035926 **
S3              -11     2.4944 -4.4098 0.0008506 ***
S4                0     0.0000
T1:S1             6     3.5277  1.7008 0.1147185
T1:S2            10     3.5277  2.8347 0.0150430 *
T1:S3             8     3.5277  2.2678 0.0426079 *
T1:S4             0     0.0000
T2:S1             0     0.0000
T2:S2             0     0.0000
T2:S3             0     0.0000
T2:S4             0     0.0000
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


 (94) MODEL

GLM(Z ~ R + T + R:T + S + S:T, ex11.1)


$ANOVA
Response : Z
                Df Sum Sq Mean Sq F value  Pr(>F)
MODEL           11     46  4.1818  2.5091 0.06452 .
RESIDUALS       12     20  1.6667
CORRECTED TOTAL 23     66
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
    Df Sum Sq Mean Sq F value Pr(>F)
R    2      9     4.5     2.7 0.1076
T    1      6     6.0     3.6 0.0821 .
R:T  2      1     0.5     0.3 0.7462
S    3      9     3.0     1.8 0.2008
T:S  3     21     7.0     4.2 0.0301 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
    Df Sum Sq Mean Sq F value Pr(>F)
R    2      9     4.5     2.7 0.1076
T    1      6     6.0     3.6 0.0821 .
R:T  2      1     0.5     0.3 0.7462
S    3      9     3.0     1.8 0.2008
T:S  3     21     7.0     4.2 0.0301 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
    Df Sum Sq Mean Sq F value Pr(>F)
R    2      9     4.5     2.7 0.1076
T    1      6     6.0     3.6 0.0821 .
R:T  2      1     0.5     0.3 0.7462
S    3      9     3.0     1.8 0.2008
T:S  3     21     7.0     4.2 0.0301 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
```

```
              Estimate Std. Error t value  Pr(>|t|)
(Intercept)       6.0    0.91287  6.5727 2.641e-05 ***
R1               -2.0    0.91287 -2.1909  0.048930 *
R2               -1.0    0.91287 -1.0954  0.294821
R3                0.0    0.00000
T1               -3.5    1.29099 -2.7111  0.018917 *
T2                0.0    0.00000
R1:T1             1.0    1.29099  0.7746  0.453571
R1:T2             0.0    0.00000
R2:T1             0.5    1.29099  0.3873  0.705317
R2:T2             0.0    0.00000
R3:T1             0.0    0.00000
R3:T2             0.0    0.00000
S1               -2.0    1.05409 -1.8974  0.082097 .
S2               -4.0    1.05409 -3.7947  0.002554 **
S3               -2.0    1.05409 -1.8974  0.082097 .
S4                0.0    0.00000
T1:S1             2.0    1.49071  1.3416  0.204550
T1:S2             5.0    1.49071  3.3541  0.005736 **
T1:S3             1.0    1.49071  0.6708  0.515039
T1:S4             0.0    0.00000
T2:S1             0.0    0.00000
T2:S2             0.0    0.00000
T2:S3             0.0    0.00000
T2:S4             0.0    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(95) MODEL

```
GLM(Y ~ R + T + R:T + S + S:T + Z, ex11.1)
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value  Pr(>F)
MODEL           12 342.45 28.5375   3.218 0.03116 *
RESIDUALS       11  97.55  8.8682
CORRECTED TOTAL 23 440.00
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
    Df Sum Sq Mean Sq F value  Pr(>F)
R    2  48.00   24.00  2.7063 0.11071
T    1  24.00   24.00  2.7063 0.12820
R:T  2  16.00    8.00  0.9021 0.43373
S    3 156.00   52.00  5.8637 0.01211 *
```

```
T:S  3  84.00    28.00  3.1574 0.06828 .
Z    1  14.45    14.45  1.6294 0.22807
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
    Df Sum Sq Mean Sq F value  Pr(>F)
R    2 18.300  9.1500  1.0318 0.38844
T    1  2.679  2.6786  0.3020 0.59359
R:T  2  9.450  4.7250  0.5328 0.60137
S    3 79.196 26.3985  2.9768 0.07822 .
T:S  3 37.474 12.4915  1.4086 0.29234
Z    1 14.450 14.4500  1.6294 0.22807
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
    Df Sum Sq Mean Sq F value  Pr(>F)
R    2 20.209 10.1043  1.1394 0.35505
T    1  6.104  6.1038  0.6883 0.42439
R:T  2  9.450  4.7250  0.5328 0.60137
S    3 84.243 28.0810  3.1665 0.06782 .
T:S  3 37.474 12.4915  1.4086 0.29234
Z    1 14.450 14.4500  1.6294 0.22807
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   11.900     4.5163  2.6349 0.023203 *
R1            -3.300     2.4915 -1.3245 0.212200
R2            -0.150     2.2085 -0.0679 0.947069
R3             0.000     0.0000
T1            -7.025     3.7815 -1.8577 0.090160 .
T2             0.000     0.0000
R1:T1          3.150     3.0515  1.0323 0.324102
R1:T2          0.000     0.0000
R2:T1          1.575     2.9965  0.5256 0.609590
R2:T2          0.000     0.0000
R3:T1          0.000     0.0000
R3:T2          0.000     0.0000
S1            -6.300     2.7723 -2.2725 0.044116 *
S2            -5.600     3.6065 -1.5528 0.148760
S3            -9.300     2.7723 -3.3546 0.006425 **
S4             0.000     0.0000
T1:S1          4.300     3.6875  1.1661 0.268238
T1:S2          5.750     4.7864  1.2013 0.254853
T1:S3          7.150     3.5025  2.0414 0.065946 .
```

```
T1:S4           0.000        0.0000
T2:S1           0.000        0.0000
T2:S2           0.000        0.0000
T2:S3           0.000        0.0000
T2:S4           0.000        0.0000
Z               0.850        0.6659   1.2765 0.228074
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.17   Example 11.2

(96) MODEL

```
ex11.2a = read.table("C:/G/Rt/Split/Ex11.2-sp3.txt", header=TRUE)
ex11.2a = af(ex11.2a, "A")
ex11.2a$MY = (ex11.2a$Y1 + ex11.2a$Y2)/sqrt(2)
ex11.2a$Z = 2*ex11.2a$Z/sqrt(2)
GLM(MY ~ Z + A, ex11.2a)
```

```
$ANOVA
Response : MY
                Df  Sum Sq Mean Sq F value  Pr(>F)
MODEL            2 234.639  117.32  9.5696 0.01953 *
RESIDUALS        5  61.298   12.26
CORRECTED TOTAL  7 295.937
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
  Df  Sum Sq Mean Sq F value  Pr(>F)
Z  1 190.148 190.148 15.5101 0.01098 *
A  1  44.492  44.492  3.6291 0.11512
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
  Df  Sum Sq Mean Sq F value Pr(>F)
Z  1 166.577 166.577 13.5874 0.0142 *
A  1  44.492  44.492  3.6291 0.1151
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
  Df  Sum Sq Mean Sq F value Pr(>F)
Z  1 166.577 166.577 13.5874 0.0142 *
A  1  44.492  44.492  3.6291 0.1151
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  15.3934    2.70222  5.6966 0.002326 **
Z             1.0219    0.27724  3.6861 0.014203 *
A1           -4.7497    2.49325 -1.9050 0.115119
A2            0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

 (97) MODEL

```
ex11.2b = read.table("C:/G/Rt/Split/Ex11.2-two.txt", header=TRUE)
ex11.2b = af(ex11.2b, c("sub", "A", "B"))
GLM(Y ~ A + A:sub + B + A:B, ex11.2b)
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value     Pr(>F)
MODEL            9 382.06  42.451  39.954 0.0001135 ***
RESIDUALS        6   6.38   1.062
CORRECTED TOTAL 15 388.44
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
      Df  Sum Sq Mean Sq F value     Pr(>F)
A      1  68.062  68.062 64.0588 0.0002029 ***
A:sub  6 227.875  37.979 35.7451 0.0001934 ***
B      1  85.562  85.562 80.5294 0.0001070 ***
A:B    1   0.562   0.562  0.5294 0.4942562
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
      Df  Sum Sq Mean Sq F value     Pr(>F)
A      1  68.062  68.062 64.0588 0.0002029 ***
A:sub  6 227.875  37.979 35.7451 0.0001934 ***
B      1  85.562  85.562 80.5294 0.0001070 ***
A:B    1   0.562   0.562  0.5294 0.4942562
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
      Df  Sum Sq Mean Sq F value    Pr(>F)
```

```
A       1  68.062  68.062 64.0588 0.0002029 ***
A:sub   6 227.875  37.979 35.7451 0.0001934 ***
B       1  85.562  85.562 80.5294 0.0001070 ***
A:B     1   0.562   0.562  0.5294 0.4942562
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   10.000    0.81490 12.2714 1.784e-05 ***
A1            -3.125    1.15244 -2.7116 0.0350301 *
A2             0.000    0.00000
A1:sub1        0.000    1.03078  0.0000 1.0000000
A1:sub2        4.500    1.03078  4.3656 0.0047414 **
A1:sub3        8.000    1.03078  7.7611 0.0002406 ***
A1:sub4        0.000    0.00000
A1:sub5        0.000    0.00000
A1:sub6        0.000    0.00000
A1:sub7        0.000    0.00000
A1:sub8        0.000    0.00000
A2:sub1        0.000    0.00000
A2:sub2        0.000    0.00000
A2:sub3        0.000    0.00000
A2:sub4        0.000    0.00000
A2:sub5        0.000    1.03078  0.0000 1.0000000
A2:sub6       10.000    1.03078  9.7014 6.883e-05 ***
A2:sub7        5.000    1.03078  4.8507 0.0028496 **
A2:sub8        0.000    0.00000
B1             5.000    0.72887  6.8599 0.0004725 ***
B2             0.000    0.00000
A1:B1         -0.750    1.03078 -0.7276 0.4942562
A1:B2          0.000    0.00000
A2:B1          0.000    0.00000
A2:B2          0.000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


 (98) MODEL
```

```
ex11.2c = read.table("C:/G/Rt/Split/Ex11.2-spcov2.txt", header=TRUE)
ex11.2c = af(ex11.2c, c("block", "whole", "split"))
GLM(Y ~ block + whole + block:whole + split + split:whole, ex11.2c)
```

```
$ANOVA
Response : Y
             Df Sum Sq Mean Sq F value  Pr(>F)
MODEL        11    328 29.8182  3.1948 0.02875 *
```

```
RESIDUALS        12     112  9.3333
CORRECTED TOTAL 23     440
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
            Df Sum Sq Mean Sq F value  Pr(>F)
block        2    48      24  2.5714 0.11765
whole        1    24      24  2.5714 0.13479
block:whole  2    16       8  0.8571 0.44880
split        3   156      52  5.5714 0.01251 *
whole:split  3    84      28  3.0000 0.07277 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
            Df Sum Sq Mean Sq F value  Pr(>F)
block        2    48      24  2.5714 0.11765
whole        1    24      24  2.5714 0.13479
block:whole  2    16       8  0.8571 0.44880
split        3   156      52  5.5714 0.01251 *
whole:split  3    84      28  3.0000 0.07277 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
            Df Sum Sq Mean Sq F value  Pr(>F)
block        2    48      24  2.5714 0.11765
whole        1    24      24  2.5714 0.13479
block:whole  2    16       8  0.8571 0.44880
split        3   156      52  5.5714 0.01251 *
whole:split  3    84      28  3.0000 0.07277 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
              Estimate Std. Error t value  Pr(>|t|)
(Intercept)        17     2.1602  7.8695 4.448e-06 ***
block1             -5     2.1602 -2.3146 0.0391521 *
block2             -1     2.1602 -0.4629 0.6517110
block3              0     0.0000
whole1            -10     3.0551 -3.2733 0.0066627 **
whole2              0     0.0000
block1:whole1       4     3.0551  1.3093 0.2149461
block1:whole2       0     0.0000
block2:whole1       2     3.0551  0.6547 0.5250404
block2:whole2       0     0.0000
block3:whole1       0     0.0000
```

```
block3:whole2          0      0.0000
split1                -8      2.4944 -3.2071 0.0075321 **
split2                -9      2.4944 -3.6080 0.0035926 **
split3               -11      2.4944 -4.4098 0.0008506 ***
split4                 0      0.0000
whole1:split1          6      3.5277  1.7008 0.1147185
whole1:split2         10      3.5277  2.8347 0.0150430 *
whole1:split3          8      3.5277  2.2678 0.0426079 *
whole1:split4          0      0.0000
whole2:split1          0      0.0000
whole2:split2          0      0.0000
whole2:split3          0      0.0000
whole2:split4          0      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(99) MODEL

```
GLM(Z ~ block + whole + block:whole + split + split:whole, ex11.2c)
```

```
$ANOVA
Response : Z
                Df Sum Sq Mean Sq    F value      Pr(>F)
MODEL           11     38  3.4545 3.5903e+15 < 2.2e-16 ***
RESIDUALS       12      0  0.0000
CORRECTED TOTAL 23     38
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
            Df Sum Sq Mean Sq     F value Pr(>F)
block        2 36.000 18.0000 1.8707e+16 <2e-16 ***
whole        1  0.667  0.6667 6.9286e+14 <2e-16 ***
block:whole  2  1.333  0.6667 6.9286e+14 <2e-16 ***
split        3  0.000  0.0000 0.0000e+00      1
whole:split  3  0.000  0.0000 0.0000e+00      1
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
            Df Sum Sq Mean Sq     F value Pr(>F)
block        2 36.000 18.0000 1.8707e+16 <2e-16 ***
whole        1  0.667  0.6667 6.9286e+14 <2e-16 ***
block:whole  2  1.333  0.6667 6.9286e+14 <2e-16 ***
split        3  0.000  0.0000 0.0000e+00      1
whole:split  3  0.000  0.0000 0.0000e+00      1
---
```

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
             Df Sum Sq Mean Sq   F value Pr(>F)
block   2 36.000 18.0000 1.8707e+16 <2e-16 ***
whole   1 0.667 0.6667 6.9286e+14 <2e-16 ***
block:whole   2 1.333 0.6667 6.9286e+14 <2e-16 ***
split   3 0.000 0.0000 0.0000e+00   1
whole:split   3 0.000 0.0000 0.0000e+00   1

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
                Estimate Std. Error   t value Pr(>|t|)
(Intercept)   5 2.1934e-08   227957476   <2e-16 ***
block1   -3 2.1934e-08 -136774486   <2e-16 ***
block2   -1 2.1934e-08 -45591495   <2e-16 ***
block3   0 0.0000e+00
whole1   0 3.1019e-08   0   1
whole2   0 0.0000e+00
block1:whole1   0 3.1019e-08   0   1
block1:whole2   0 0.0000e+00
block2:whole1   -1 3.1019e-08   -32238055   <2e-16 ***
block2:whole2   0 0.0000e+00
block3:whole1   0 0.0000e+00
block3:whole2   0 0.0000e+00
split1   0 2.5327e-08   0   1
split2   0 2.5327e-08   0   1
split3   0 2.5327e-08   0   1
split4   0 0.0000e+00
whole1:split1   0 3.5818e-08   0   1
whole1:split2   0 3.5818e-08   0   1
whole1:split3   0 3.5818e-08   0   1
whole1:split4   0 0.0000e+00
whole2:split1   0 0.0000e+00
whole2:split2   0 0.0000e+00
whole2:split3   0 0.0000e+00
whole2:split4   0 0.0000e+00

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(100) MODEL

```
GLM(Y ~ block + whole + block:whole + split + split:whole + Z, ex11.2c)
```


$ANOVA
Response : Y

```
                  Df Sum Sq Mean Sq F value  Pr(>F)
MODEL             11     328 29.8182  3.1948 0.02875 *
RESIDUALS         12     112  9.3333
CORRECTED TOTAL 23       440
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
            Df Sum Sq Mean Sq F value  Pr(>F)
block        2     48      24  2.5714 0.11765
whole        1     24      24  2.5714 0.13479
block:whole  2     16       8  0.8571 0.44880
split        3    156      52  5.5714 0.01251 *
whole:split  3     84      28  3.0000 0.07277 .
Z            0
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
            Df  Sum Sq Mean Sq F value  Pr(>F)
block        2  13.286   6.643  0.7117 0.51039
whole        1  16.000  16.000  1.7143 0.21495
block:whole  1  16.000  16.000  1.7143 0.21495
split        3 156.000  52.000  5.5714 0.01251 *
whole:split  3  84.000  28.000  3.0000 0.07277 .
Z            0
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
CAUTION: Singularity Exists !
            Df  Sum Sq Mean Sq F value  Pr(>F)
block        2  13.286   6.643  0.7117 0.51039
whole        1  16.000  16.000  1.7143 0.21495
block:whole  1  16.000  16.000  1.7143 0.21495
split        3 156.000  52.000  5.5714 0.01251 *
whole:split  3  84.000  28.000  3.0000 0.07277 .
Z            0
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)       17     2.1602  7.8695 4.448e-06 ***
block1            -5     2.1602 -2.3146 0.0391521 *
block2            -1     2.1602 -0.4629 0.6517110
block3             0     0.0000
whole1           -10     3.0551 -3.2733 0.0066627 **
```

```
whole2               0     0.0000
block1:whole1        4     3.0551  1.3093 0.2149461
block1:whole2        0     0.0000
block2:whole1        2     3.0551   0.6547 0.5250404
block2:whole2        0     0.0000
block3:whole1        0     0.0000
block3:whole2        0     0.0000
split1              -8     2.4944 -3.2071 0.0075321 **
split2              -9     2.4944 -3.6080 0.0035926 **
split3             -11     2.4944 -4.4098 0.0008506 ***
split4               0     0.0000
whole1:split1        6     3.5277  1.7008 0.1147185
whole1:split2       10     3.5277  2.8347 0.0150430 *
whole1:split3        8     3.5277  2.2678 0.0426079 *
whole1:split4        0     0.0000
whole2:split1        0     0.0000
whole2:split2        0     0.0000
whole2:split3        0     0.0000
whole2:split4        0     0.0000
Z                    0     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.18   Example 11.3

(101) MODEL

```
ex11.3 = read.table("C:/G/Rt/Split/Ex11.3-sbcov.txt", header=TRUE)
ex11.3 = af(ex11.3, c("block", "A", "B"))
GLM(Y ~ block + A + block:A + B + block:B + A:B, ex11.3)
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL           17 16.833  0.9902  1.9804 0.2038
RESIDUALS        6  3.000  0.5000
CORRECTED TOTAL 23 19.833

$`Type I`
        Df Sum Sq Mean Sq F value  Pr(>F)
block    3 4.5000  1.5000  3.0000 0.11696
A        1 1.5000  1.5000  3.0000 0.13397
block:A  3 0.5000  0.1667  0.3333 0.80220
B        2 8.3333  4.1667  8.3333 0.01855 *
block:B  6 1.0000  0.1667  0.3333 0.89648
A:B      2 1.0000  0.5000  1.0000 0.42188
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
        Df Sum Sq Mean Sq F value  Pr(>F)
block    3 4.5000  1.5000  3.0000 0.11696
A        1 1.5000  1.5000  3.0000 0.13397
block:A  3 0.5000  0.1667  0.3333 0.80220
B        2 8.3333  4.1667  8.3333 0.01855 *
block:B  6 1.0000  0.1667  0.3333 0.89648
A:B      2 1.0000  0.5000  1.0000 0.42188
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
        Df Sum Sq Mean Sq F value  Pr(>F)
block    3 4.5000  1.5000  3.0000 0.11696
A        1 1.5000  1.5000  3.0000 0.13397
block:A  3 0.5000  0.1667  0.3333 0.80220
B        2 8.3333  4.1667  8.3333 0.01855 *
block:B  6 1.0000  0.1667  0.3333 0.89648
A:B      2 1.0000  0.5000  1.0000 0.42188
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   4.5000    0.61237  7.3485 0.000325 ***
block1       -1.3333    0.81650 -1.6330 0.153590
block2       -0.3333    0.81650 -0.4082 0.697261
block3       -0.3333    0.81650 -0.4082 0.697261
block4        0.0000    0.00000
A1           -1.0000    0.70711 -1.4142 0.207031
A2            0.0000    0.00000
block1:A1     0.6667    0.81650  0.8165 0.445416
block1:A2     0.0000    0.00000
block2:A1     0.6667    0.81650  0.8165 0.445416
block2:A2     0.0000    0.00000
block3:A1     0.6667    0.81650  0.8165 0.445416
block3:A2     0.0000    0.00000
block4:A1     0.0000    0.00000
block4:A2     0.0000    0.00000
B1           -0.7500    0.79057 -0.9487 0.379410
B2           -1.7500    0.79057 -2.2136 0.068802 .
B3            0.0000    0.00000
block1:B1    -0.5000    1.00000 -0.5000 0.634880
block1:B2     0.5000    1.00000  0.5000 0.634880
block1:B3     0.0000    0.00000
```

```
block2:B1     -0.5000     1.00000 -0.5000 0.634880
block2:B2      0.5000     1.00000  0.5000 0.634880
block2:B3      0.0000     0.00000
block3:B1      0.0000     1.00000  0.0000 1.000000
block3:B2      0.0000     1.00000  0.0000 1.000000
block3:B3      0.0000     0.00000
block4:B1      0.0000     0.00000
block4:B2      0.0000     0.00000
block4:B3      0.0000     0.00000
A1:B1         -0.5000     0.70711 -0.7071 0.506021
A1:B2          0.5000     0.70711  0.7071 0.506021
A1:B3          0.0000     0.00000
A2:B1          0.0000     0.00000
A2:B2          0.0000     0.00000
A2:B3          0.0000     0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(102) MODEL

```
GLM(Z ~ block + A + block:A + B + block:B + A:B, ex11.3)
```

```
$ANOVA
Response : Z
                Df Sum Sq Mean Sq F value  Pr(>F)
MODEL           17 31.167 1.83333     3.3 0.07324 .
RESIDUALS        6  3.333 0.55556
CORRECTED TOTAL 23 34.500
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
        Df  Sum Sq Mean Sq F value  Pr(>F)
block    3  6.8333  2.2778     4.1 0.06689 .
A        1  6.0000  6.0000    10.8 0.01669 *
block:A  3  1.6667  0.5556     1.0 0.45472
B        2 13.0000  6.5000    11.7 0.00850 **
block:B  6  3.6667  0.6111     1.1 0.45542
A:B      2  0.0000  0.0000     0.0 1.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
        Df  Sum Sq Mean Sq F value  Pr(>F)
block    3  6.8333  2.2778     4.1 0.06689 .
A        1  6.0000  6.0000    10.8 0.01669 *
block:A  3  1.6667  0.5556     1.0 0.45472
```

```
B         2 13.0000  6.5000      11.7 0.00850 **
block:B   6  3.6667  0.6111       1.1 0.45542
A:B       2  0.0000  0.0000       0.0 1.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
        Df  Sum Sq Mean Sq F value  Pr(>F)
block    3  6.8333  2.2778     4.1 0.06689 .
A        1  6.0000  6.0000    10.8 0.01669 *
block:A  3  1.6667  0.5556     1.0 0.45472
B        2 13.0000  6.5000    11.7 0.00850 **
block:B  6  3.6667  0.6111     1.1 0.45542
A:B      2  0.0000  0.0000     0.0 1.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  2.83333    0.64550  4.3894 0.004621 **
block1       0.00000    0.86066  0.0000 1.000000
block2       1.83333    0.86066  2.1301 0.077194 .
block3      -0.16667    0.86066 -0.1936 0.852840
block4       0.00000    0.00000
A1          -1.66667    0.74536 -2.2361 0.066707 .
A2           0.00000    0.00000
block1:A1    1.00000    0.86066  1.1619 0.289403
block1:A2    0.00000    0.00000
block2:A1    0.33333    0.86066  0.3873 0.711901
block2:A2    0.00000    0.00000
block3:A1    1.33333    0.86066  1.5492 0.172308
block3:A2    0.00000    0.00000
block4:A1    0.00000    0.00000
block4:A2    0.00000    0.00000
B1          -0.50000    0.83333 -0.6000 0.570456
B2          -1.00000    0.83333 -1.2000 0.275367
B3           0.00000    0.00000
block1:B1   -2.00000    1.05409 -1.8974 0.106558
block1:B2    0.00000    1.05409  0.0000 1.000000
block1:B3    0.00000    0.00000
block2:B1   -2.00000    1.05409 -1.8974 0.106558
block2:B2   -0.50000    1.05409 -0.4743 0.652027
block2:B3    0.00000    0.00000
block3:B1   -1.00000    1.05409 -0.9487 0.379410
block3:B2   -0.50000    1.05409 -0.4743 0.652027
block3:B3    0.00000    0.00000
block4:B1    0.00000    0.00000
block4:B2    0.00000    0.00000
```

```
block4:B3     0.00000      0.00000
A1:B1         0.00000      0.74536  0.0000 1.000000
A1:B2         0.00000      0.74536  0.0000 1.000000
A1:B3         0.00000      0.00000
A2:B1         0.00000      0.00000
A2:B2         0.00000      0.00000
A2:B3         0.00000      0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(103) MODEL

```
GLM(Y ~ block + A + block:A + B + block:B + A:B + Z, ex11.3)
```

```
$ANOVA
Response : Y
                Df  Sum Sq Mean Sq F value Pr(>F)
MODEL           18 17.8417 0.99120  2.4884 0.1589
RESIDUALS        5  1.9917 0.39833
CORRECTED TOTAL 23 19.8333


$`Type I`
        Df Sum Sq Mean Sq F value  Pr(>F)
block    3 4.5000  1.5000  3.7657 0.09378 .
A        1 1.5000  1.5000  3.7657 0.10999
block:A  3 0.5000  0.1667  0.4184 0.74788
B        2 8.3333  4.1667 10.4603 0.01634 *
block:B  6 1.0000  0.1667  0.4184 0.84059
A:B      2 1.0000  0.5000  1.2552 0.36163
Z        1 1.0083  1.0083  2.5314 0.17248
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
        Df Sum Sq Mean Sq F value Pr(>F)
block    3 3.6203 1.20678  3.0296 0.1319
A        1 0.0000 0.00000  0.0000 1.0000
block:A  3 0.2583 0.08611  0.2162 0.8813
B        2 1.0317 0.51587  1.2951 0.3522
block:B  6 0.4210 0.07017  0.1762 0.9717
A:B      2 1.0000 0.50000  1.2552 0.3616
Z        1 1.0083 1.00833  2.5314 0.1725


$`Type III`
        Df Sum Sq Mean Sq F value Pr(>F)
block    3 3.6613 1.22045  3.0639 0.1297
A        1 0.0054 0.00536  0.0134 0.9122
```

```
block:A  3 0.2583 0.08611  0.2162 0.8813
B        2 0.7685 0.38427  0.9647 0.4423
block:B  6 0.4210 0.07017  0.1762 0.9717
A:B      2 1.0000 0.50000  1.2552 0.3616
Z        1 1.0083 1.00833  2.5314 0.1725


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  2.94167    1.12164  2.6227  0.04695 *
block1      -1.33333    0.72877 -1.8296  0.12684
block2      -1.34167    0.96580 -1.3892  0.22347
block3      -0.24167    0.73105 -0.3306  0.75437
block4       0.00000    0.00000
A1          -0.08333    0.85456 -0.0975  0.92611
A2           0.00000    0.00000
block1:A1    0.11667    0.80660  0.1446  0.89065
block1:A2    0.00000    0.00000
block2:A1    0.48333    0.73783  0.6551  0.54135
block2:A2    0.00000    0.00000
block3:A1   -0.06667    0.86230 -0.0773  0.94137
block3:A2    0.00000    0.00000
block4:A1    0.00000    0.00000
block4:A2    0.00000    0.00000
B1          -0.47500    0.72649 -0.6538  0.54210
B2          -1.20000    0.78576 -1.5272  0.18725
B3           0.00000    0.00000
block1:B1    0.60000    1.12901  0.5314  0.61787
block1:B2    0.50000    0.89256  0.5602  0.59952
block1:B3    0.00000    0.00000
block2:B1    0.60000    1.12901  0.5314  0.61787
block2:B2    0.77500    0.90914  0.8525  0.43289
block2:B3    0.00000    0.00000
block3:B1    0.55000    0.95717  0.5746  0.59044
block3:B2    0.27500    0.90914  0.3025  0.77446
block3:B3    0.00000    0.00000
block4:B1    0.00000    0.00000
block4:B2    0.00000    0.00000
block4:B3    0.00000    0.00000
A1:B1       -0.50000    0.63114 -0.7922  0.46414
A1:B2        0.50000    0.63114  0.7922  0.46414
A1:B3        0.00000    0.00000
A2:B1        0.00000    0.00000
A2:B2        0.00000    0.00000
A2:B3        0.00000    0.00000
Z            0.55000    0.34569  1.5910  0.17248
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8 Hinkelmann & Kempthorne - Volume 1

Reference

- Hinkelmann K, Kempthorne O. Design and Analysis of Experiments Volume 1 Introduction to Experimental Design. 2e. John Wiley & Sons Inc. 2008.

8.1 Chapter 6

8.1.1 p202

(104) MODEL

```
v1p202 = read.table("C:/G/Rt/Kemp/v1p202.txt", head=TRUE)
v1p202 = af(v1p202,c("brand"))
GLM(miles ~ brand, v1p202) # OK
```

```
$ANOVA
Response : miles
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            4 47.234  11.809  15.661 0.004924 **
RESIDUALS       5  3.770   0.754
CORRECTED TOTAL 9 51.004
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
brand  4 47.234  11.809  15.661 0.004924 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
brand  4 47.234  11.809  15.661 0.004924 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
brand  4 47.234  11.809  15.661 0.004924 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
           Estimate Std. Error t value  Pr(>|t|)
```

```
(Intercept)     25.90     0.61400 42.1822 1.413e-07 ***
brand1          -1.05     0.86833 -1.2092   0.28063
brand2           2.30     0.86833  2.6488   0.04549 *
brand3          -2.75     0.86833 -3.1670   0.02490 *
brand4           3.20     0.86833  3.6852   0.01422 *
brand5           0.00     0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.1.2 p205

(105) MODEL

```
v1p205 = read.table("C:/G/Rt/Kemp/v1p205.txt", head=TRUE)
v1p205 = af(v1p205,c("brand", "car"))
GLM(miles ~ brand + car %in% brand, v1p205) # OK
```

```
$ANOVA
Response : miles
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            9 140.05  15.561   80.21 1.017e-13 ***
RESIDUALS       20   3.88   0.194
CORRECTED TOTAL 29 143.93
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
          Df  Sum Sq Mean Sq  F value     Pr(>F)
brand      4 133.243  33.311 171.7053 3.553e-15 ***
brand:car  5   6.803   1.361   7.0137 0.0006214 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
          Df  Sum Sq Mean Sq  F value     Pr(>F)
brand      4 133.243  33.311 171.7053 3.553e-15 ***
brand:car  5   6.803   1.361   7.0137 0.0006214 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
          Df  Sum Sq Mean Sq  F value     Pr(>F)
brand      4 133.243  33.311 171.7053 3.553e-15 ***
brand:car  5   6.803   1.361   7.0137 0.0006214 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
            Estimate Std. Error  t value  Pr(>|t|)
(Intercept)  25.9000     0.25430 101.8496 < 2.2e-16 ***
brand1       -2.0333     0.35963  -5.6540 1.559e-05 ***
brand2        2.2333     0.35963   6.2101 4.580e-06 ***
brand3       -2.3667     0.35963  -6.5808 2.068e-06 ***
brand4        2.9333     0.35963   8.1565 8.629e-08 ***
brand5        0.0000     0.00000
brand1:car1   1.9333     0.35963   5.3759 2.915e-05 ***
brand1:car2   0.0000     0.00000
brand2:car1   0.1667     0.35963   0.4634   0.64805
brand2:car2   0.0000     0.00000
brand3:car1  -0.8667     0.35963  -2.4099   0.02571 *
brand3:car2   0.0000     0.00000
brand4:car1  -0.1333     0.35963  -0.3708   0.71472
brand4:car2   0.0000     0.00000
brand5:car1   0.0333     0.35963   0.0927   0.92707
brand5:car2   0.0000     0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.2 Chapter 7

8.2.1 p232

(106) MODEL

```
v1p232 = read.table("C:/G/Rt/Kemp/v1p232.txt", head=TRUE)
v1p232 = af(v1p232,c("trt"))
GLM(yield ~ trt, v1p232) # OK
```

```
$ANOVA
Response : yield
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL            4 59.174  14.793  28.781 0.0012 **
RESIDUALS        5  2.570   0.514
CORRECTED TOTAL  9 61.744
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
    Df Sum Sq Mean Sq F value Pr(>F)
trt  4 59.174  14.793  28.781 0.0012 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
    Df Sum Sq Mean Sq F value Pr(>F)
trt  4 59.174  14.793  28.781 0.0012 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
    Df Sum Sq Mean Sq F value Pr(>F)
trt  4 59.174  14.793  28.781 0.0012 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)    13.35    0.50695 26.3339 1.476e-06 ***
trtA1           4.85    0.71694  6.7649 0.0010724 **
trtA2          -0.20    0.71694 -0.2790 0.7914426
trtB1           5.75    0.71694  8.0202 0.0004871 ***
trtB2           2.55    0.71694  3.5568 0.0162698 *
trtC            0.00    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.2.2   p235

(107) MODEL

```
v1p235 = read.table("C:/G/Rt/Kemp/v1p235.txt", head=TRUE)
v1p235 = af(v1p235,c("density"))
GLM(yield ~ density, v1p235) # OK
```

```
$ANOVA
Response : yield
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            4 88.007 22.0017  32.198 1.095e-05 ***
RESIDUALS       10  6.833  0.6833
CORRECTED TOTAL 14 94.840
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
        Df Sum Sq Mean Sq F value    Pr(>F)
density  4 88.007  22.002  32.198 1.095e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
        Df Sum Sq Mean Sq F value    Pr(>F)
density  4 88.007  22.002  32.198 1.095e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
        Df Sum Sq Mean Sq F value    Pr(>F)
density  4 88.007  22.002  32.198 1.095e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)  16.9667    0.47726 35.5501 7.362e-12 ***
density10    -4.9667    0.67495 -7.3586 2.429e-05 ***
density20    -0.9667    0.67495 -1.4322    0.1826
density30     2.0667    0.67495  3.0620    0.0120 *
density40     1.0333    0.67495  1.5310    0.1568
density50     0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.3   Chapter 8

8.3.1   p265

(108) MODEL

```r
v1p265 = read.table("C:/G/Rt/Kemp/v1p265.txt", head=TRUE)
v1p265 = af(v1p265,c("trt"))
GLM(y ~ trt + x, v1p265) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            3 84.678 28.2260  36.866 4.941e-06 ***
RESIDUALS       11  8.422  0.7656
CORRECTED TOTAL 14 93.100
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
    Df Sum Sq Mean Sq F value    Pr(>F)
trt  2 66.868  33.434  43.668 5.858e-06 ***
```

```
x    1 17.810  17.810  23.262 0.0005333 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
    Df Sum Sq Mean Sq F value    Pr(>F)
trt  2 83.147  41.573  54.299 1.996e-06 ***
x    1 17.810  17.810  23.262 0.0005333 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
    Df Sum Sq Mean Sq F value    Pr(>F)
trt  2 83.147  41.573  54.299 1.996e-06 ***
x    1 17.810  17.810  23.262 0.0005333 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   2.7154    0.81801  3.3196 0.0068363 **
trt1          6.2245    0.60214 10.3374 5.301e-07 ***
trt2          2.9315    0.56116  5.2239 0.0002838 ***
trt3          0.0000    0.00000
x             0.7733    0.16034  4.8230 0.0005333 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.3.2 p272

(109) MODEL

```
GLM(y ~ trt + x %in% trt, v1p265) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            5 85.711  17.142  20.881 0.0001046 ***
RESIDUALS        9  7.389   0.821
CORRECTED TOTAL 14 93.100
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
trt    2 66.868  33.434 40.7254 3.092e-05 ***
```

```
trt:x  3 18.843   6.281   7.6509   0.007578 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
trt    2 66.868  33.434 40.7254 3.092e-05 ***
trt:x  3 18.843   6.281  7.6509  0.007578 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
      Df  Sum Sq Mean Sq F value    Pr(>F)
trt    2  6.1392  3.0696  3.7390 0.065769 .
trt:x  3 18.8433  6.2811  7.6509 0.007578 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.7395    1.25360  2.9830 0.015375 *
trt1          4.5929    1.73483  2.6475 0.026586 *
trt2          1.2883    1.85702  0.6937 0.505359
trt3          0.0000    0.00000
trt1:x        0.9759    0.37622  2.5938 0.029031 *
trt2:x        0.8957    0.25864  3.4630 0.007127 **
trt3:x        0.5448    0.26480  2.0572 0.069793 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.3.3 p273

(110) MODEL

```
GLM(y ~ trt + x + x %in% trt, v1p265) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            5 85.711  17.142  20.881 0.0001046 ***
RESIDUALS        9  7.389   0.821
CORRECTED TOTAL 14 93.100
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
```

```
       Df Sum Sq Mean Sq F value    Pr(>F)
trt     2 66.868  33.434 40.7254 3.092e-05 ***
x       1 17.810  17.810 21.6940  0.001189 **
trt:x   2  1.033   0.517  0.6294  0.554843
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
       Df Sum Sq Mean Sq F value    Pr(>F)
trt     2 83.147  41.573 50.6397 1.267e-05 ***
x       1 17.810  17.810 21.6940  0.001189 **
trt:x   2  1.033   0.517  0.6294  0.554843
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
       Df  Sum Sq Mean Sq F value   Pr(>F)
trt     2  6.1392  3.0696  3.7390 0.065769 .
x       1 17.2071 17.2071 20.9597 0.001331 **
trt:x   2  1.0334  0.5167  0.6294 0.554843
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.7395    1.25360  2.9830  0.01537 *
trt1          4.5929    1.73483  2.6475  0.02659 *
trt2          1.2883    1.85702  0.6937  0.50536
trt3          0.0000    0.00000
x             0.5448    0.26480  2.0572  0.06979 .
trt1:x        0.4311    0.46007  0.9370  0.37320
trt2:x        0.3509    0.37016  0.9481  0.36785
trt3:x        0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.4   Chapter 9

8.4.1   p344

(111) MODEL

```
v1p344 = read.table("C:/G/Rt/Kemp/v1p344.txt", head=TRUE)
v1p344 = af(v1p344,c("diet", "litter"))
GLM(gain ~ litter + diet, v1p344)
```

```
$ANOVA
```

```
Response : gain
               Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           9 4915.6  546.18  15.544 3.363e-07 ***
RESIDUALS      20  702.8   35.14
CORRECTED TOTAL 29 5618.4
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
       Df Sum Sq Mean Sq F value    Pr(>F)
litter  5 4438.0   887.6 25.2608 5.298e-08 ***
diet    4  477.6   119.4  3.3981   0.02824 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
       Df Sum Sq Mean Sq F value    Pr(>F)
litter  5 4438.0   887.6 25.2608 5.298e-08 ***
diet    4  477.6   119.4  3.3981   0.02824 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
       Df Sum Sq Mean Sq F value    Pr(>F)
litter  5 4438.0   887.6 25.2608 5.298e-08 ***
diet    4  477.6   119.4  3.3981   0.02824 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   54.357     3.4224 15.8828 8.344e-13 ***
litter1       19.940     3.7490  5.3187 3.318e-05 ***
litter2       17.100     3.7490  4.5612 0.0001897 ***
litter3       20.920     3.7490  5.5801 1.839e-05 ***
litter4       26.360     3.7490  7.0312 8.062e-07 ***
litter5       41.040     3.7490 10.9469 6.767e-10 ***
litter6        0.000     0.0000
diet1        -12.367     3.4224 -3.6135 0.0017332 **
diet2         -7.650     3.4224 -2.2353 0.0369629 *
diet3         -8.100     3.4224 -2.3668 0.0281448 *
diet4         -6.567     3.4224 -1.9188 0.0694012 .
diet5          0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.4.2 p349

(112) MODEL

```
v1p349 = read.table("C:/G/Rt/Kemp/v1p349.txt", head=TRUE)
v1p349 = af(v1p349,c("subject", "exercise"))
GLM(diast ~ subject + exercise + subject:exercise, v1p349) # OK
```

```
$ANOVA
Response : diast
                Df Sum Sq Mean Sq F value     Pr(>F)
MODEL           14 1541.5 110.105  28.475 2.953e-08 ***
RESIDUALS       15   58.0   3.867
CORRECTED TOTAL 29 1599.5
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
                Df Sum Sq Mean Sq F value     Pr(>F)
subject          4 905.13 226.283 58.5216 5.672e-09 ***
exercise         2 591.27 295.633 76.4569 1.357e-08 ***
subject:exercise 8  45.07   5.633  1.4569    0.2522
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
                Df Sum Sq Mean Sq F value     Pr(>F)
subject          4 905.13 226.283 58.5216 5.672e-09 ***
exercise         2 591.27 295.633 76.4569 1.357e-08 ***
subject:exercise 8  45.07   5.633  1.4569    0.2522
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
                Df Sum Sq Mean Sq F value     Pr(>F)
subject          4 905.13 226.283 58.5216 5.672e-09 ***
exercise         2 591.27 295.633 76.4569 1.357e-08 ***
subject:exercise 8  45.07   5.633  1.4569    0.2522
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)    135.0     1.3904 97.0913 < 2.2e-16 ***
subject1         0.5     1.9664  0.2543 0.8027368
subject2         5.0     1.9664  2.5427 0.0225198 *
subject3        -5.5     1.9664 -2.7970 0.0135411 *
```

306

```
subject4               10.0      1.9664  5.0855 0.0001343 ***
subject5                0.0      0.0000
exercise1             -12.0      1.9664 -6.1026 2.023e-05 ***
exercise2               0.5      1.9664  0.2543 0.8027368
exercise3               0.0      0.0000
subject1:exercise1      4.0      2.7809  1.4384 0.1708608
subject1:exercise2      0.0      2.7809  0.0000 1.0000000
subject1:exercise3      0.0      0.0000
subject2:exercise1      8.0      2.7809  2.8768 0.0115245 *
subject2:exercise2      2.0      2.7809  0.7192 0.4830757
subject2:exercise3      0.0      0.0000
subject3:exercise1      2.0      2.7809  0.7192 0.4830757
subject3:exercise2      2.0      2.7809  0.7192 0.4830757
subject3:exercise3      0.0      0.0000
subject4:exercise1      2.5      2.7809  0.8990 0.3828608
subject4:exercise2      0.0      2.7809  0.0000 1.0000000
subject4:exercise3      0.0      0.0000
subject5:exercise1      0.0      0.0000
subject5:exercise2      0.0      0.0000
subject5:exercise3      0.0      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.4.3 p354

(113) MODEL

```
v1p354 = read.table("C:/G/Rt/Kemp/v1p354.txt", head=TRUE)
v1p354 = af(v1p354,c("loc", "block", "HSF"))
GLM(height ~ loc + block %in% loc + HSF + loc:HSF + block:loc:HSF, v1p354) # OK
```

```
$ANOVA
Response : height
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           23  40782 1773.12  80.444 < 2.2e-16 ***
RESIDUALS       24    529   22.04
CORRECTED TOTAL 47  41311
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
            Df  Sum Sq Mean Sq  F value    Pr(>F)
loc          1 20336.3 20336.3 922.6314 < 2.2e-16 ***
loc:block    6  1462.3   243.7  11.0573 6.408e-06 ***
HSF          2 12170.7  6085.3 276.0832 < 2.2e-16 ***
loc:HSF      2  6511.2  3255.6 147.7013 3.242e-14 ***
```

```
loc:block:HSF 12    301.2     25.1    1.1386     0.3769
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
              Df  Sum Sq Mean Sq  F value    Pr(>F)
loc            1 20336.3 20336.3 922.6314 < 2.2e-16 ***
loc:block      6  1462.3   243.7  11.0573 6.408e-06 ***
HSF            2 12170.7  6085.3 276.0832 < 2.2e-16 ***
loc:HSF        2  6511.2  3255.6 147.7013 3.242e-14 ***
loc:block:HSF 12   301.2    25.1   1.1386    0.3769
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
              Df  Sum Sq Mean Sq  F value    Pr(>F)
loc            1 20336.3 20336.3 922.6314 < 2.2e-16 ***
loc:block      6  1462.3   243.7  11.0573 6.408e-06 ***
HSF            2 12170.7  6085.3 276.0832 < 2.2e-16 ***
loc:HSF        2  6511.2  3255.6 147.7013 3.242e-14 ***
loc:block:HSF 12   301.2    25.1   1.1386    0.3769
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
                 Estimate Std. Error t value  Pr(>|t|)
(Intercept)         191.0     3.3198 57.5342 < 2.2e-16 ***
loc1                 22.5     4.6949  4.7925 7.039e-05 ***
loc2                  0.0     0.0000
loc1:block1         -20.0     4.6949 -4.2600 0.0002727 ***
loc1:block2          -8.0     4.6949 -1.7040 0.1012979
loc1:block3          -9.0     4.6949 -1.9170 0.0672189 .
loc1:block4           0.0     0.0000
loc2:block1         -10.5     4.6949 -2.2365 0.0348764 *
loc2:block2          -4.5     4.6949 -0.9585 0.3473697
loc2:block3          10.0     4.6949  2.1300 0.0436248 *
loc2:block4           0.0     0.0000
HSF1                 -3.0     4.6949 -0.6390 0.5288766
HSF2                  9.5     4.6949  2.0235 0.0542951 .
HSF3                  0.0     0.0000
loc1:HSF1            17.0     6.6395  2.5604 0.0171697 *
loc1:HSF2            53.5     6.6395  8.0578 2.778e-08 ***
loc1:HSF3             0.0     0.0000
loc2:HSF1             0.0     0.0000
loc2:HSF2             0.0     0.0000
loc2:HSF3             0.0     0.0000
loc1:block1:HSF1      8.0     6.6395  1.2049 0.2399873
loc1:block1:HSF2     -0.5     6.6395 -0.0753 0.9405950
```

```
loc1:block1:HSF3      0.0      0.0000
loc1:block2:HSF1     -1.5      6.6395 -0.2259 0.8231768
loc1:block2:HSF2     -0.5      6.6395 -0.0753 0.9405950
loc1:block2:HSF3      0.0      0.0000
loc1:block3:HSF1      4.0      6.6395  0.6025 0.5525233
loc1:block3:HSF2      6.5      6.6395  0.9790 0.3373533
loc1:block3:HSF3      0.0      0.0000
loc1:block4:HSF1      0.0      0.0000
loc1:block4:HSF2      0.0      0.0000
loc1:block4:HSF3      0.0      0.0000
loc2:block1:HSF1     -1.0      6.6395 -0.1506 0.8815396
loc2:block1:HSF2      2.0      6.6395  0.3012 0.7658364
loc2:block1:HSF3      0.0      0.0000
loc2:block2:HSF1     -1.5      6.6395 -0.2259 0.8231768
loc2:block2:HSF2      3.5      6.6395  0.5271 0.6029315
loc2:block2:HSF3      0.0      0.0000
loc2:block3:HSF1    -12.0      6.6395 -1.8074 0.0832589 .
loc2:block3:HSF2    -13.0      6.6395 -1.9580 0.0619570 .
loc2:block3:HSF3      0.0      0.0000
loc2:block4:HSF1      0.0      0.0000
loc2:block4:HSF2      0.0      0.0000
loc2:block4:HSF3      0.0      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.4.4 p357

(114) MODEL

```
v1p357 = read.table("C:/G/Rt/Kemp/v1p357.txt", head=TRUE)
v1p357 = af(v1p357,c("var", "N"))
GLM(y ~ var + N + var:N, v1p357) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value   Pr(>F)
MODEL            9 4465.5  496.16  14.116 0.000142 ***
RESIDUALS       10  351.5   35.15
CORRECTED TOTAL 19 4816.9
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
      Df Sum Sq Mean Sq F value     Pr(>F)
var    1  140.5  140.45  3.9957   0.073519 .
N      4 3393.7  848.42 24.1373 4.027e-05 ***
```

309

```
var:N  4  931.3  232.82  6.6238  0.007152 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
     Df Sum Sq Mean Sq F value    Pr(>F)
var   1  140.5  140.45  3.9957  0.073519 .
N     4 3393.7  848.43 24.1373 4.027e-05 ***
var:N  4  931.3  232.82  6.6238  0.007152 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
     Df Sum Sq Mean Sq F value    Pr(>F)
var   1  140.5  140.45  3.9957  0.073519 .
N     4 3393.7  848.42 24.1373 4.027e-05 ***
var:N  4  931.3  232.83  6.6238  0.007152 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)    134.0     4.1923 31.9637 2.114e-11 ***
var1             5.5     5.9287  0.9277  0.375420
var2             0.0     0.0000
N1             -17.5     5.9287 -2.9517  0.014492 *
N2              25.0     5.9287  4.2167  0.001781 **
N3              20.0     5.9287  3.3734  0.007081 **
N4               3.5     5.9287  0.5903  0.568060
N5               0.0     0.0000
var1:N1        -13.0     8.3845 -1.5505  0.152072
var1:N2        -32.5     8.3845 -3.8762  0.003078 **
var1:N3        -15.5     8.3845 -1.8486  0.094254 .
var1:N4          7.0     8.3845  0.8349  0.423286
var1:N5          0.0     0.0000
var2:N1          0.0     0.0000
var2:N2          0.0     0.0000
var2:N3          0.0     0.0000
var2:N4          0.0     0.0000
var2:N5          0.0     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.4.5 p361

(115) MODEL

```
v1p361 = read.table("C:/G/Rt/Kemp/v1p361.txt", head=TRUE)
v1p361 = af(v1p361,c("block", "trt"))
GLM(y ~ block + trt, v1p361) # OK
```

```
$ANOVA
Response : y
                 Df Sum Sq Mean Sq F value Pr(>F)
MODEL             4 241.33  60.333  40.222 0.1176
RESIDUALS         1   1.50   1.500
CORRECTED TOTAL   5 242.83


$`Type I`
      Df  Sum Sq Mean Sq F value  Pr(>F)
block  2  24.333  12.167  8.1111 0.24097
trt    2 217.000 108.500 72.3333 0.08286 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
      Df Sum Sq Mean Sq F value  Pr(>F)
block  2    108    54.0  36.000 0.11704
trt    2    217   108.5  72.333 0.08286 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
      Df Sum Sq Mean Sq F value  Pr(>F)
block  2    108    54.0  36.000 0.11704
trt    2    217   108.5  72.333 0.08286 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)     19.5     1.1180 17.4413  0.03646 *
block1         -12.0     1.4142 -8.4853  0.07468 .
block2          -6.0     1.4142 -4.2426  0.14736
block3           0.0     0.0000
trt1            16.0     1.4142 11.3137  0.05612 .
trt2             3.0     1.4142  2.1213  0.28044
trt3             0.0     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
y = model.frame(y ~ block + trt, v1p361)[,1]
x = ModelMatrix(y ~ block + trt, v1p361)
```

```
rx = lfit(x, y)
K = cbind(rep(1, 3), matrix(1/3, nrow=3, ncol=3), diag(3)) ; K
```

```
     [,1]      [,2]      [,3]      [,4] [,5] [,6] [,7]
[1,]    1 0.3333333 0.3333333 0.3333333    1    0    0
[2,]    1 0.3333333 0.3333333 0.3333333    0    1    0
[3,]    1 0.3333333 0.3333333 0.3333333    0    0    1
```

```
est(K, rx)
```

```
     Estimate Std. Error t value Pr(>|t|)
[1,]     29.5    0.95743  30.812  0.02065 *
[2,]     16.5    0.95743  17.234  0.03690 *
[3,]     13.5    0.95743  14.100  0.04507 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.5   Chapter 10

8.5.1   p405

(116) MODEL

```
v1p405 = read.table("C:/G/Rt/Kemp/v1p405.txt", head=TRUE)
v1p405 = af(v1p405,c("trt", "Row", "Col"))
GLM(y ~ Row + Col + trt, v1p405) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value  Pr(>F)
MODEL           12 4094.7  341.23  2.3416 0.07739 .
RESIDUALS       12 1748.7  145.73
CORRECTED TOTAL 24 5843.4
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
    Df  Sum Sq Mean Sq F value  Pr(>F)
Row  4  514.24  128.56  0.8822 0.50328
Col  4 1711.44  427.86  2.9360 0.06611 .
trt  4 1869.04  467.26  3.2064 0.05229 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
    Df  Sum Sq Mean Sq F value  Pr(>F)
Row  4  514.24  128.56  0.8822 0.50328
Col  4 1711.44  427.86  2.9360 0.06611 .
trt  4 1869.04  467.26  3.2064 0.05229 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
    Df  Sum Sq Mean Sq F value  Pr(>F)
Row  4  514.24  128.56  0.8822 0.50328
Col  4 1711.44  427.86  2.9360 0.06611 .
trt  4 1869.04  467.26  3.2064 0.05229 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)  102.16     8.7050 11.7357 6.195e-08 ***
Row1          12.00     7.6348  1.5717  0.141991
Row2           4.00     7.6348  0.5239  0.609878
Row3           6.00     7.6348  0.7859  0.447183
Row4          -0.40     7.6348 -0.0524  0.959079
Row5           0.00     0.0000
Col1           5.80     7.6348  0.7597  0.462112
Col2          -6.60     7.6348 -0.8645  0.404285
Col3         -18.80     7.6348 -2.4624  0.029907 *
Col4          -1.80     7.6348 -0.2358  0.817593
Col5           0.00     0.0000
trt1         -25.00     7.6348 -3.2745  0.006648 **
trt2          -3.20     7.6348 -0.4191  0.682525
trt3          -7.20     7.6348 -0.9430  0.364257
trt4          -9.00     7.6348 -1.1788  0.261321
trt5           0.00     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.5.2 p408

(117) MODEL

```
v1p408 = read.table("C:/G/Rt/Kemp/v1p408.txt", head=TRUE)
v1p408 = af(v1p408,c("breed", "farm", "wclass", "dosage"))
GLM(response ~ breed + breed:farm + wclass + dosage + breed:dosage, v1p408) # OK
```

```
$ANOVA
```

```
Response : response
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           16 4470.2 279.391  140.87 2.039e-13 ***
RESIDUALS       15   29.7   1.983
CORRECTED TOTAL 31 4500.0
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
            Df Sum Sq Mean Sq   F value    Pr(>F)
breed        1 3280.5  3280.5 1654.0336 < 2.2e-16 ***
breed:farm   6    9.0     1.5    0.7563    0.6146
wclass       3  466.8   155.6   78.4454 2.142e-09 ***
dosage       3  580.2   193.4   97.5210 4.596e-10 ***
breed:dosage 3  133.8    44.6   22.4790 8.366e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
            Df Sum Sq Mean Sq   F value    Pr(>F)
breed        1 3280.5  3280.5 1654.0336 < 2.2e-16 ***
breed:farm   6    9.0     1.5    0.7563    0.6146
wclass       3  466.7   155.6   78.4454 2.142e-09 ***
dosage       3  580.2   193.4   97.5210 4.596e-10 ***
breed:dosage 3  133.8    44.6   22.4790 8.366e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
            Df Sum Sq Mean Sq   F value    Pr(>F)
breed        1 3280.5  3280.5 1654.0336 < 2.2e-16 ***
breed:farm   6    9.0     1.5    0.7563    0.6146
wclass       3  466.8   155.6   78.4454 2.142e-09 ***
dosage       3  580.3   193.4   97.5210 4.596e-10 ***
breed:dosage 3  133.7    44.6   22.4790 8.366e-06 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
              Estimate Std. Error  t value  Pr(>|t|)
(Intercept)    168.500    1.02647 164.1544 < 2.2e-16 ***
breed1         -19.750    1.31735 -14.9922 1.956e-10 ***
breed2           0.000    0.00000
breed1:farm1     0.500    0.99582   0.5021 0.6228896
breed1:farm2    -0.500    0.99582  -0.5021 0.6228896
breed1:farm3     0.500    0.99582   0.5021 0.6228896
breed1:farm4     0.000    0.00000
breed2:farm1    -0.750    0.99582  -0.7531 0.4630208
```

```
breed2:farm2    -1.750    0.99582  -1.7573 0.0992451 .
breed2:farm3    -1.000    0.99582  -1.0042 0.3312109
breed2:farm4     0.000    0.00000
wclass1        -10.375    0.70415 -14.7340 2.498e-10 ***
wclass2         -6.000    0.70415  -8.5209 3.927e-07 ***
wclass3         -3.125    0.70415  -4.4379 0.0004791 ***
wclass4          0.000    0.00000
dosageC         -1.000    0.99582  -1.0042 0.3312109
dosageH         14.000    0.99582  14.0587 4.829e-10 ***
dosageL         -0.500    0.99582  -0.5021 0.6228896
dosageM          0.000    0.00000
breed1:dosageC   1.750    1.40831   1.2426 0.2330815
breed1:dosageH  -8.500    1.40831  -6.0356 2.281e-05 ***
breed1:dosageL   0.750    1.40831   0.5326 0.6021431
breed1:dosageM   0.000    0.00000
breed2:dosageC   0.000    0.00000
breed2:dosageH   0.000    0.00000
breed2:dosageL   0.000    0.00000
breed2:dosageM   0.000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.5.3 p410

(118) MODEL

```
v1p410 = read.table("C:/G/Rt/Kemp/v1p410.txt", head=TRUE)
v1p410$carry = ifelse(v1p410$carry == 0, 3, v1p410$carry)
v1p410 = af(v1p410,c("period", "sequence", "steer", "trt", "carry"))
GLM(y ~ period + sequence + steer:sequence + trt + carry, v1p410) # OK
```

```
$ANOVA
Response : y
                Df  Sum Sq Mean Sq F value    Pr(>F)
MODEL           17 1302.51  76.618  8.7402 1.572e-05 ***
RESIDUALS       18  157.79   8.766
CORRECTED TOTAL 35 1460.31
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
              Df Sum Sq Mean Sq F value    Pr(>F)
period         2 292.06 146.028 16.6580 8.038e-05 ***
sequence       5 326.47  65.294  7.4484 0.0006072 ***
sequence:steer 6 118.50  19.750  2.2530 0.0849122 .
trt            2 549.06 274.528 31.3166 1.377e-06 ***
```

```
carry            2  16.43    8.215   0.9372 0.4100385
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
              Df Sum Sq Mean Sq F value    Pr(>F)
period         2 172.31  86.154  9.8279 0.0013030 **
sequence       5 318.69  63.738  7.2709 0.0006954 ***
sequence:steer 6 118.50  19.750  2.2530 0.0849122 .
trt            2 440.61 220.304 25.1311 6.164e-06 ***
carry          2  16.43    8.215  0.9372 0.4100385
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
              Df Sum Sq Mean Sq F value    Pr(>F)
period         2 172.31  86.154  9.8279 0.0013030 **
sequence       5 318.69  63.738  7.2709 0.0006954 ***
sequence:steer 6 118.50  19.750  2.2530 0.0849122 .
trt            2 440.61 220.304 25.1311 6.164e-06 ***
carry          2  16.43    8.215  0.9372 0.4100385
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
                  Estimate Std. Error t value  Pr(>|t|)
(Intercept)         52.854     2.3407 22.5805 1.177e-14 ***
period1             -6.604     1.5990 -4.1302 0.0006286 ***
period2             -0.083     1.2087 -0.0689 0.9457953
period3              0.000     0.0000
sequence1            3.208     2.4919  1.2875 0.2142212
sequence2           -3.000     2.4175 -1.2410 0.2305478
sequence3           -6.771     2.4919 -2.7172 0.0141265 *
sequence4           -1.438     2.4919 -0.5769 0.5711674
sequence5           -2.458     2.4919 -0.9865 0.3369431
sequence6            0.000     0.0000
sequence1:steer1    -3.667     2.4175 -1.5167 0.1466983
sequence1:steer10    0.000     0.0000
sequence1:steer11    0.000     0.0000
sequence1:steer12    0.000     0.0000
sequence1:steer2     0.000     0.0000
sequence1:steer3     0.000     0.0000
sequence1:steer4     0.000     0.0000
sequence1:steer5     0.000     0.0000
sequence1:steer6     0.000     0.0000
sequence1:steer7     0.000     0.0000
sequence1:steer8     0.000     0.0000
sequence1:steer9     0.000     0.0000
```

```
sequence2:steer1      0.000     0.0000
sequence2:steer10     0.000     0.0000
sequence2:steer11     0.000     0.0000
sequence2:steer12     0.000     0.0000
sequence2:steer2      0.000     0.0000
sequence2:steer3     -4.333     2.4175 -1.7925 0.0898747 .
sequence2:steer4      0.000     0.0000
sequence2:steer5      0.000     0.0000
sequence2:steer6      0.000     0.0000
sequence2:steer7      0.000     0.0000
sequence2:steer8      0.000     0.0000
sequence2:steer9      0.000     0.0000
sequence3:steer1      0.000     0.0000
sequence3:steer10     0.000     0.0000
sequence3:steer11     0.000     0.0000
sequence3:steer12     0.000     0.0000
sequence3:steer2      0.000     0.0000
sequence3:steer3      0.000     0.0000
sequence3:steer4      0.000     0.0000
sequence3:steer5     -3.333     2.4175 -1.3789 0.1848347
sequence3:steer6      0.000     0.0000
sequence3:steer7      0.000     0.0000
sequence3:steer8      0.000     0.0000
sequence3:steer9      0.000     0.0000
sequence4:steer1      0.000     0.0000
sequence4:steer10     0.000     0.0000
sequence4:steer11     0.000     0.0000
sequence4:steer12     0.000     0.0000
sequence4:steer2      0.000     0.0000
sequence4:steer3      0.000     0.0000
sequence4:steer4      0.000     0.0000
sequence4:steer5      0.000     0.0000
sequence4:steer6      0.000     0.0000
sequence4:steer7     -3.333     2.4175 -1.3789 0.1848347
sequence4:steer8      0.000     0.0000
sequence4:steer9      0.000     0.0000
sequence5:steer1      0.000     0.0000
sequence5:steer10     3.667     2.4175  1.5167 0.1466983
sequence5:steer11     0.000     0.0000
sequence5:steer12     0.000     0.0000
sequence5:steer2      0.000     0.0000
sequence5:steer3      0.000     0.0000
sequence5:steer4      0.000     0.0000
sequence5:steer5      0.000     0.0000
sequence5:steer6      0.000     0.0000
sequence5:steer7      0.000     0.0000
sequence5:steer8      0.000     0.0000
sequence5:steer9      0.000     0.0000
```

```
sequence6:steer1      0.000      0.0000
sequence6:steer10     0.000      0.0000
sequence6:steer11    -3.333      2.4175 -1.3789 0.1848347
sequence6:steer12     0.000      0.0000
sequence6:steer2      0.000      0.0000
sequence6:steer3      0.000      0.0000
sequence6:steer4      0.000      0.0000
sequence6:steer5      0.000      0.0000
sequence6:steer6      0.000      0.0000
sequence6:steer7      0.000      0.0000
sequence6:steer8      0.000      0.0000
sequence6:steer9      0.000      0.0000
trt1                  9.542      1.3514  7.0606 1.384e-06 ***
trt2                  5.521      1.3514  4.0853 0.0006946 ***
trt3                  0.000      0.0000
carry1                0.375      1.8131  0.2068 0.8384657
carry2               -1.938      1.8131 -1.0686 0.2993665
carry3                0.000      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(y ~ period + sequence + steer:sequence + trt + carry, v1p410), type=3,
      singular.ok=TRUE) # NOT OK for sequence
```

```
Note: model has aliased coefficients
      sums of squares computed by model comparison


Anova Table (Type III tests)

Response: y
               Sum Sq Df F values     Pr(>F)
period         172.31  2   9.8279  0.001303 **
sequence         0.00  0
trt            440.61  2  25.1311 6.164e-06 ***
carry           16.43  2   0.9372  0.410038
sequence:steer 118.50  6   2.2530  0.084912 .
Residuals      157.79 18
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.6   Chapter 11

8.6.1   p432

(119) MODEL

```
v1p432 = read.table("C:/G/Rt/Kemp/v1p432.txt", head=TRUE)
v1p432 = af(v1p432,c("V", "Block", "A", "B", "C"))
GLM(Y ~ V + Block:V + A + B + A:B + V:A + V:B + V:A:B + Block:A:V + Block:B:V,
    v1p432) # OK
```

$ANOVA
Response : Y
                  Df Sum Sq Mean Sq F value   Pr(>F)
MODEL   94 261663 2783.65 30.584 2.065e-14 ***
RESIDUALS   25   2275   91.02
CORRECTED TOTAL 119 263939

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
           Df Sum Sq Mean Sq F value   Pr(>F)
V   4 102743   25686 282.2094 < 2.2e-16 ***
V:Block   25 50019   2001 21.9825 1.588e-11 ***
A   1 18451   18451 202.7233 1.692e-13 ***
B   1 78541   78541 862.9280 < 2.2e-16 ***
A:B   1   108   108   1.1899   0.28575
V:A   4   3751   938 10.3023 4.532e-05 ***
V:B   4   307   77   0.8421   0.51168
V:A:B   4   1495   374   4.1058   0.01081 *
V:Block:A 25   3416   137   1.5011   0.15818
V:Block:B 25   2833   113   1.2451   0.29390

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
           Df Sum Sq Mean Sq F value   Pr(>F)
V   4 102743   25686 282.2094 < 2.2e-16 ***
V:Block   25 50019   2001 21.9825 1.588e-11 ***
A   1 18451   18451 202.7233 1.692e-13 ***
B   1 78541   78541 862.9280 < 2.2e-16 ***
A:B   1   108   108   1.1899   0.28575
V:A   4   3751   938 10.3023 4.532e-05 ***
V:B   4   307   77   0.8421   0.51168
V:A:B   4   1495   374   4.1058   0.01081 *
V:Block:A 25   3416   137   1.5011   0.15818
V:Block:B 25   2833   113   1.2451   0.29390

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
           Df Sum Sq Mean Sq F value   Pr(>F)
V   4 102743   25686 282.2094 < 2.2e-16 ***
```

```
V:Block    25  50019     2001  21.9825 1.588e-11 ***
A           1  18451    18451 202.7233 1.692e-13 ***
B           1  78541    78541 862.9280 < 2.2e-16 ***
A:B         1    108      108   1.1899   0.28575
V:A         4   3751      938  10.3023 4.532e-05 ***
V:B         4    307       77   0.8421   0.51168
V:A:B       4   1495      374   4.1058   0.01081 *
V:Block:A  25   3416      137   1.5011   0.15818
V:Block:B  25   2833      113   1.2451   0.29390
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   727.67     8.4885 85.7237 < 2.2e-16 ***
VAm           -89.00    12.0046 -7.4138 9.141e-08 ***
VCo           -30.58    12.0046 -2.5476 0.0173738 *
VFe           -36.62    12.0046 -3.0509 0.0053411 **
VHa           -53.37    12.0046 -4.4462 0.0001566 ***
VPi             0.00     0.0000
VAm:Block1    -65.00    11.6844 -5.5630 8.751e-06 ***
VAm:Block2    -70.75    11.6844 -6.0551 2.512e-06 ***
VAm:Block3    -38.50    11.6844 -3.2950 0.0029414 **
VAm:Block4    -43.25    11.6844 -3.7015 0.0010618 **
VAm:Block5    -21.50    11.6844 -1.8401 0.0776619 .
VAm:Block6      0.00     0.0000
VCo:Block1    -54.25    11.6844 -4.6429 9.401e-05 ***
VCo:Block2    -50.75    11.6844 -4.3434 0.0002043 ***
VCo:Block3    -54.75    11.6844 -4.6857 8.414e-05 ***
VCo:Block4    -34.25    11.6844 -2.9313 0.0071180 **
VCo:Block5    -31.50    11.6844 -2.6959 0.0123750 *
VCo:Block6      0.00     0.0000
VFe:Block1    -48.00    11.6844 -4.1080 0.0003752 ***
VFe:Block2    -46.75    11.6844 -4.0011 0.0004941 ***
VFe:Block3    -43.25    11.6844 -3.7015 0.0010618 **
VFe:Block4    -31.25    11.6844 -2.6745 0.0130019 *
VFe:Block5    -10.00    11.6844 -0.8558 0.4002135
VFe:Block6      0.00     0.0000
VHa:Block1    -57.00    11.6844 -4.8783 5.108e-05 ***
VHa:Block2    -74.50    11.6844 -6.3760 1.127e-06 ***
VHa:Block3    -57.50    11.6844 -4.9211 4.572e-05 ***
VHa:Block4    -41.25    11.6844 -3.5304 0.0016360 **
VHa:Block5    -15.50    11.6844 -1.3266 0.1966467
VHa:Block6      0.00     0.0000
VPi:Block1    -31.00    11.6844 -2.6531 0.0136586 *
VPi:Block2    -55.25    11.6844 -4.7285 7.530e-05 ***
VPi:Block3    -57.75    11.6844 -4.9425 4.325e-05 ***
VPi:Block4    -37.00    11.6844 -3.1666 0.0040322 **
```

```
VPi:Block5        -4.00     11.6844 -0.3423 0.7349587
VPi:Block6         0.00      0.0000
AF               -14.33     10.3047 -1.3910 0.1764960
AM                 0.00      0.0000
BH               -52.33     10.3047 -5.0786 3.042e-05 ***
BL                 0.00      0.0000
AF:BH             -5.33      7.7896 -0.6847 0.4998485
AF:BL              0.00      0.0000
AM:BH              0.00      0.0000
AM:BL              0.00      0.0000
VAm:AF            34.00     14.5730  2.3331 0.0279872 *
VAm:AM             0.00      0.0000
VCo:AF           -29.83     14.5730 -2.0472 0.0512888 .
VCo:AM             0.00      0.0000
VFe:AF           -26.75     14.5730 -1.8356 0.0783425 .
VFe:AM             0.00      0.0000
VHa:AF           -21.25     14.5730 -1.4582 0.1572413
VHa:AM             0.00      0.0000
VPi:AF             0.00      0.0000
VPi:AM             0.00      0.0000
VAm:BH            -5.00     14.5730 -0.3431 0.7343914
VAm:BL             0.00      0.0000
VCo:BH            -4.83     14.5730 -0.3317 0.7429077
VCo:BL             0.00      0.0000
VFe:BH            19.25     14.5730  1.3209 0.1984868
VFe:BL             0.00      0.0000
VHa:BH           -17.25     14.5730 -1.1837 0.2476668
VHa:BL             0.00      0.0000
VPi:BH             0.00      0.0000
VPi:BL             0.00      0.0000
VAm:AF:BH        -15.00     11.0161 -1.3616 0.1854582
VAm:AF:BL          0.00      0.0000
VAm:AM:BH          0.00      0.0000
VAm:AM:BL          0.00      0.0000
VCo:AF:BH         19.67     11.0161  1.7853 0.0863588 .
VCo:AF:BL          0.00      0.0000
VCo:AM:BH          0.00      0.0000
VCo:AM:BL          0.00      0.0000
VFe:AF:BH        -12.50     11.0161 -1.1347 0.2672649
VFe:AF:BL          0.00      0.0000
VFe:AM:BH          0.00      0.0000
VFe:AM:BL          0.00      0.0000
VHa:AF:BH         15.50     11.0161  1.4070 0.1717311
VHa:AF:BL          0.00      0.0000
VHa:AM:BH          0.00      0.0000
VHa:AM:BL          0.00      0.0000
VPi:AF:BH          0.00      0.0000
VPi:AF:BL          0.00      0.0000
```

```
VPi:AM:BH         0.00      0.0000
VPi:AM:BL         0.00      0.0000
VAm:Block1:AF   -14.00     13.4920 -1.0377 0.3093639
VAm:Block1:AM     0.00      0.0000
VAm:Block2:AF   -14.50     13.4920 -1.0747 0.2927668
VAm:Block2:AM     0.00      0.0000
VAm:Block3:AF   -26.00     13.4920 -1.9271 0.0654087 .
VAm:Block3:AM     0.00      0.0000
VAm:Block4:AF   -19.50     13.4920 -1.4453 0.1607920
VAm:Block4:AM     0.00      0.0000
VAm:Block5:AF     0.00     13.4920  0.0000 1.0000000
VAm:Block5:AM     0.00      0.0000
VAm:Block6:AF     0.00      0.0000
VAm:Block6:AM     0.00      0.0000
VCo:Block1:AF     6.50     13.4920  0.4818 0.6341615
VCo:Block1:AM     0.00      0.0000
VCo:Block2:AF   -10.50     13.4920 -0.7782 0.4437309
VCo:Block2:AM     0.00      0.0000
VCo:Block3:AF     1.50     13.4920  0.1112 0.9123636
VCo:Block3:AM     0.00      0.0000
VCo:Block4:AF    -2.50     13.4920 -0.1853 0.8544925
VCo:Block4:AM     0.00      0.0000
VCo:Block5:AF    21.00     13.4920  1.5565 0.1321638
VCo:Block5:AM     0.00      0.0000
VCo:Block6:AF     0.00      0.0000
VCo:Block6:AM     0.00      0.0000
VFe:Block1:AF    20.00     13.4920  1.4824 0.1507406
VFe:Block1:AM     0.00      0.0000
VFe:Block2:AF    20.50     13.4920  1.5194 0.1412033
VFe:Block2:AM     0.00      0.0000
VFe:Block3:AF    36.50     13.4920  2.7053 0.0121084 *
VFe:Block3:AM     0.00      0.0000
VFe:Block4:AF    30.50     13.4920  2.2606 0.0327423 *
VFe:Block4:AM     0.00      0.0000
VFe:Block5:AF    17.00     13.4920  1.2600 0.2193017
VFe:Block5:AM     0.00      0.0000
VFe:Block6:AF     0.00      0.0000
VFe:Block6:AM     0.00      0.0000
VHa:Block1:AF     2.00     13.4920  0.1482 0.8833455
VHa:Block1:AM     0.00      0.0000
VHa:Block2:AF    16.00     13.4920  1.1859 0.2468148
VHa:Block2:AM     0.00      0.0000
VHa:Block3:AF    19.00     13.4920  1.4082 0.1713737
VHa:Block3:AM     0.00      0.0000
VHa:Block4:AF    -0.50     13.4920 -0.0371 0.9707322
VHa:Block4:AM     0.00      0.0000
VHa:Block5:AF   -27.00     13.4920 -2.0012 0.0563396 .
VHa:Block5:AM     0.00      0.0000
```

```
VHa:Block6:AF      0.00      0.0000
VHa:Block6:AM      0.00      0.0000
VPi:Block1:AF    -16.00     13.4920 -1.1859 0.2468148
VPi:Block1:AM      0.00      0.0000
VPi:Block2:AF    -14.50     13.4920 -1.0747 0.2927668
VPi:Block2:AM      0.00      0.0000
VPi:Block3:AF    -12.50     13.4920 -0.9265 0.3630565
VPi:Block3:AM      0.00      0.0000
VPi:Block4:AF    -11.00     13.4920 -0.8153 0.4226006
VPi:Block4:AM      0.00      0.0000
VPi:Block5:AF    -16.00     13.4920 -1.1859 0.2468148
VPi:Block5:AM      0.00      0.0000
VPi:Block6:AF      0.00      0.0000
VPi:Block6:AM      0.00      0.0000
VAm:Block1:BH     30.00     13.4920  2.2235 0.0354473 *
VAm:Block1:BL      0.00      0.0000
VAm:Block2:BH     24.50     13.4920  1.8159 0.0813993 .
VAm:Block2:BL      0.00      0.0000
VAm:Block3:BH      4.00     13.4920  0.2965 0.7693182
VAm:Block3:BL      0.00      0.0000
VAm:Block4:BH      6.50     13.4920  0.4818 0.6341615
VAm:Block4:BL      0.00      0.0000
VAm:Block5:BH      1.00     13.4920  0.0741 0.9415063
VAm:Block5:BL      0.00      0.0000
VAm:Block6:BH      0.00      0.0000
VAm:Block6:BL      0.00      0.0000
VCo:Block1:BH    -12.50     13.4920 -0.9265 0.3630565
VCo:Block1:BL      0.00      0.0000
VCo:Block2:BH     -4.50     13.4920 -0.3335 0.7415143
VCo:Block2:BL      0.00      0.0000
VCo:Block3:BH      1.50     13.4920  0.1112 0.9123636
VCo:Block3:BL      0.00      0.0000
VCo:Block4:BH     -6.50     13.4920 -0.4818 0.6341615
VCo:Block4:BL      0.00      0.0000
VCo:Block5:BH      4.00     13.4920  0.2965 0.7693182
VCo:Block5:BL      0.00      0.0000
VCo:Block6:BH      0.00      0.0000
VCo:Block6:BL      0.00      0.0000
VFe:Block1:BH     -8.00     13.4920 -0.5929 0.5585441
VFe:Block1:BL      0.00      0.0000
VFe:Block2:BH    -12.50     13.4920 -0.9265 0.3630565
VFe:Block2:BL      0.00      0.0000
VFe:Block3:BH    -11.50     13.4920 -0.8524 0.4021071
VFe:Block3:BL      0.00      0.0000
VFe:Block4:BH      0.50     13.4920  0.0371 0.9707322
VFe:Block4:BL      0.00      0.0000
VFe:Block5:BH     -2.00     13.4920 -0.1482 0.8833455
VFe:Block5:BL      0.00      0.0000
```

```
VFe:Block6:BH      0.00      0.0000
VFe:Block6:BL      0.00      0.0000
VHa:Block1:BH      8.00     13.4920   0.5929 0.5585441
VHa:Block1:BL      0.00      0.0000
VHa:Block2:BH     15.00     13.4920   1.1118 0.2768138
VHa:Block2:BL      0.00      0.0000
VHa:Block3:BH     21.00     13.4920   1.5565 0.1321638
VHa:Block3:BL      0.00      0.0000
VHa:Block4:BH     33.50     13.4920   2.4830 0.0200965 *
VHa:Block4:BL      0.00      0.0000
VHa:Block5:BH     14.00     13.4920   1.0377 0.3093639
VHa:Block5:BL      0.00      0.0000
VHa:Block6:BH      0.00      0.0000
VHa:Block6:BL      0.00      0.0000
VPi:Block1:BH    -14.00     13.4920  -1.0377 0.3093639
VPi:Block1:BL      0.00      0.0000
VPi:Block2:BH     17.50     13.4920   1.2971 0.2064513
VPi:Block2:BL      0.00      0.0000
VPi:Block3:BH     24.50     13.4920   1.8159 0.0813993 .
VPi:Block3:BL      0.00      0.0000
VPi:Block4:BH      8.00     13.4920   0.5929 0.5585441
VPi:Block4:BL      0.00      0.0000
VPi:Block5:BH     -3.00     13.4920  -0.2224 0.8258445
VPi:Block5:BL      0.00      0.0000
VPi:Block6:BH      0.00      0.0000
VPi:Block6:BL      0.00      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.6.2 p434

(120) MODEL

```
GLM(Y ~ V + Block:V + A + B + A:B + V:A + V:B + V:A:B, v1p432) # OK
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           44 255415  5804.9  51.075 < 2.2e-16 ***
RESIDUALS       75   8524   113.7
CORRECTED TOTAL 119 263939
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
        Df Sum Sq Mean Sq  F value     Pr(>F)
```

```
V          4 102743   25686 225.9988 < 2.2e-16 ***
V:Block 25  50019    2001  17.6040 < 2.2e-16 ***
A          1  18451   18451 162.3447 < 2.2e-16 ***
B          1  78541   78541 691.0494 < 2.2e-16 ***
A:B        1    108     108   0.9529   0.33212
V:A        4   3751     938   8.2503 1.435e-05 ***
V:B        4    307      77   0.6744   0.61182
V:A:B      4   1495     374   3.2880   0.01541 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
        Df Sum Sq Mean Sq  F value     Pr(>F)
V          4 102743   25686 225.9988 < 2.2e-16 ***
V:Block 25  50019    2001  17.6040 < 2.2e-16 ***
A          1  18451   18451 162.3447 < 2.2e-16 ***
B          1  78541   78541 691.0494 < 2.2e-16 ***
A:B        1    108     108   0.9529   0.33212
V:A        4   3751     938   8.2503 1.435e-05 ***
V:B        4    307      77   0.6744   0.61182
V:A:B      4   1495     374   3.2880   0.01541 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
        Df Sum Sq Mean Sq  F value     Pr(>F)
V          4 102743   25686 225.9988 < 2.2e-16 ***
V:Block 25  50019    2001  17.6040 < 2.2e-16 ***
A          1  18451   18451 162.3447 < 2.2e-16 ***
B          1  78541   78541 691.0494 < 2.2e-16 ***
A:B        1    108     108   0.9529   0.33212
V:A        4   3751     938   8.2503 1.435e-05 ***
V:B        4    307      77   0.6744   0.61182
V:A:B      4   1495     374   3.2880   0.01541 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error  t value  Pr(>|t|)
(Intercept)   730.75     6.5284 111.9335 < 2.2e-16 ***
VAm           -91.42     9.2326  -9.9015 2.887e-15 ***
VCo           -33.50     9.2326  -3.6284 0.0005179 ***
VFe           -47.29     9.2326  -5.1223 2.269e-06 ***
VHa           -64.87     9.2326  -7.0267 8.274e-10 ***
VPi             0.00     0.0000
VAm:Block1    -57.00     7.5384  -7.5613 8.123e-11 ***
VAm:Block2    -65.75     7.5384  -8.7220 5.032e-13 ***
VAm:Block3    -49.50     7.5384  -6.5664 5.963e-09 ***
```

```
VAm:Block4     -49.75      7.5384   -6.5996 5.177e-09 ***
VAm:Block5     -21.00      7.5384   -2.7857 0.0067590 **
VAm:Block6       0.00      0.0000
VCo:Block1     -57.25      7.5384   -7.5945 7.029e-11 ***
VCo:Block2     -58.25      7.5384   -7.7271 3.938e-11 ***
VCo:Block3     -53.25      7.5384   -7.0638 7.048e-10 ***
VCo:Block4     -38.75      7.5384   -5.1404 2.113e-06 ***
VCo:Block5     -19.00      7.5384   -2.5204 0.0138466 *
VCo:Block6       0.00      0.0000
VFe:Block1     -42.00      7.5384   -5.5715 3.771e-07 ***
VFe:Block2     -42.75      7.5384   -5.6710 2.515e-07 ***
VFe:Block3     -30.75      7.5384   -4.0791 0.0001116 ***
VFe:Block4     -15.75      7.5384   -2.0893 0.0400719 *
VFe:Block5      -2.50      7.5384   -0.3316 0.7410890
VFe:Block6       0.00      0.0000
VHa:Block1     -52.00      7.5384   -6.8980 1.441e-09 ***
VHa:Block2     -59.00      7.5384   -7.8266 2.549e-11 ***
VHa:Block3     -37.50      7.5384   -4.9745 4.038e-06 ***
VHa:Block4     -24.75      7.5384   -3.2832 0.0015606 **
VHa:Block5     -22.00      7.5384   -2.9184 0.0046415 **
VHa:Block6       0.00      0.0000
VPi:Block1     -46.00      7.5384   -6.1021 4.234e-08 ***
VPi:Block2     -53.75      7.5384   -7.1302 5.290e-10 ***
VPi:Block3     -51.75      7.5384   -6.8649 1.662e-09 ***
VPi:Block4     -38.50      7.5384   -5.1072 2.407e-06 ***
VPi:Block5     -13.50      7.5384   -1.7908 0.0773547 .
VPi:Block6       0.00      0.0000
AF             -26.00      6.1551   -4.2242 6.669e-05 ***
AM               0.00      0.0000
BH             -46.83      6.1551   -7.6089 6.600e-11 ***
BL               0.00      0.0000
AF:BH           -5.33      8.7046   -0.6127 0.5419251
AF:BL            0.00      0.0000
AM:BH            0.00      0.0000
AM:BL            0.00      0.0000
VAm:AF          33.33      8.7046    3.8294 0.0002645 ***
VAm:AM           0.00      0.0000
VCo:AF         -15.50      8.7046   -1.7807 0.0790155 .
VCo:AM           0.00      0.0000
VFe:AF           5.67      8.7046    0.6510 0.5170370
VFe:AM           0.00      0.0000
VHa:AF          -8.00      8.7046   -0.9191 0.3610122
VHa:AM           0.00      0.0000
VPi:AF           0.00      0.0000
VPi:AM           0.00      0.0000
VAm:BH           0.50      8.7046    0.0574 0.9543466
VAm:BL           0.00      0.0000
VCo:BH         -13.33      8.7046   -1.5318 0.1297887
```

```
VCo:BL           0.00      0.0000
VFe:BH           8.17      8.7046    0.9382 0.3511512
VFe:BL           0.00      0.0000
VHa:BH          -7.50      8.7046   -0.8616 0.3916454
VHa:BL           0.00      0.0000
VPi:BH           0.00      0.0000
VPi:BL           0.00      0.0000
VAm:AF:BH      -15.00     12.3101   -1.2185 0.2268497
VAm:AF:BL        0.00      0.0000
VAm:AM:BH        0.00      0.0000
VAm:AM:BL        0.00      0.0000
VCo:AF:BH       19.67     12.3101    1.5976 0.1143369
VCo:AF:BL        0.00      0.0000
VCo:AM:BH        0.00      0.0000
VCo:AM:BL        0.00      0.0000
VFe:AF:BH      -12.50     12.3101   -1.0154 0.3131683
VFe:AF:BL        0.00      0.0000
VFe:AM:BH        0.00      0.0000
VFe:AM:BL        0.00      0.0000
VHa:AF:BH       15.50     12.3101    1.2591 0.2118897
VHa:AF:BL        0.00      0.0000
VHa:AM:BH        0.00      0.0000
VHa:AM:BL        0.00      0.0000
VPi:AF:BH        0.00      0.0000
VPi:AF:BL        0.00      0.0000
VPi:AM:BH        0.00      0.0000
VPi:AM:BL        0.00      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.6.3   p438

(121) MODEL

```
GLM(Y ~ V + Block:V + C + V:C, v1p432) # OK
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           44 255415  5804.9  51.075 < 2.2e-16 ***
RESIDUALS       75   8524   113.7
CORRECTED TOTAL 119 263939
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
```

```
          Df Sum Sq Mean Sq  F value     Pr(>F)
V          4 102743   25686 225.9988 < 2.2e-16 ***
V:Block 25  50019    2001  17.6040 < 2.2e-16 ***
C          3  97100   32367 284.7823 < 2.2e-16 ***
V:C       12   5552     463   4.0709  7.23e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
          Df Sum Sq Mean Sq  F value     Pr(>F)
V          4 102743   25686 225.9988 < 2.2e-16 ***
V:Block 25  50019    2001  17.6040 < 2.2e-16 ***
C          3  97100   32367 284.7823 < 2.2e-16 ***
V:C       12   5552     463   4.0709  7.23e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
          Df Sum Sq Mean Sq  F value     Pr(>F)
V          4 102743   25686 225.9988 < 2.2e-16 ***
V:Block 25  50019    2001  17.6040 < 2.2e-16 ***
C          3  97100   32367 284.7823 < 2.2e-16 ***
V:C       12   5552     463   4.0709  7.23e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error  t value  Pr(>|t|)
(Intercept)   730.75     6.5284 111.9335 < 2.2e-16 ***
VAm           -91.42     9.2326  -9.9015 2.887e-15 ***
VCo           -33.50     9.2326  -3.6284 0.0005179 ***
VFe           -47.29     9.2326  -5.1223 2.269e-06 ***
VHa           -64.87     9.2326  -7.0267 8.274e-10 ***
VPi             0.00     0.0000
VAm:Block1    -57.00     7.5384  -7.5613 8.123e-11 ***
VAm:Block2    -65.75     7.5384  -8.7220 5.032e-13 ***
VAm:Block3    -49.50     7.5384  -6.5664 5.963e-09 ***
VAm:Block4    -49.75     7.5384  -6.5996 5.177e-09 ***
VAm:Block5    -21.00     7.5384  -2.7857 0.0067590 **
VAm:Block6      0.00     0.0000
VCo:Block1    -57.25     7.5384  -7.5945 7.029e-11 ***
VCo:Block2    -58.25     7.5384  -7.7271 3.938e-11 ***
VCo:Block3    -53.25     7.5384  -7.0638 7.048e-10 ***
VCo:Block4    -38.75     7.5384  -5.1404 2.113e-06 ***
VCo:Block5    -19.00     7.5384  -2.5204 0.0138466 *
VCo:Block6      0.00     0.0000
VFe:Block1    -42.00     7.5384  -5.5715 3.771e-07 ***
VFe:Block2    -42.75     7.5384  -5.6710 2.515e-07 ***
```

```
VFe:Block3      -30.75      7.5384   -4.0791 0.0001116 ***
VFe:Block4      -15.75      7.5384   -2.0893 0.0400719 *
VFe:Block5       -2.50      7.5384   -0.3316 0.7410890
VFe:Block6        0.00      0.0000
VHa:Block1      -52.00      7.5384   -6.8980 1.441e-09 ***
VHa:Block2      -59.00      7.5384   -7.8266 2.549e-11 ***
VHa:Block3      -37.50      7.5384   -4.9745 4.038e-06 ***
VHa:Block4      -24.75      7.5384   -3.2832 0.0015606 **
VHa:Block5      -22.00      7.5384   -2.9184 0.0046415 **
VHa:Block6        0.00      0.0000
VPi:Block1      -46.00      7.5384   -6.1021 4.234e-08 ***
VPi:Block2      -53.75      7.5384   -7.1302 5.290e-10 ***
VPi:Block3      -51.75      7.5384   -6.8649 1.662e-09 ***
VPi:Block4      -38.50      7.5384   -5.1072 2.407e-06 ***
VPi:Block5      -13.50      7.5384   -1.7908 0.0773547 .
VPi:Block6        0.00      0.0000
C1              -78.17      6.1551  -12.6996 < 2.2e-16 ***
C2              -26.00      6.1551   -4.2242 6.669e-05 ***
C3              -46.83      6.1551   -7.6089 6.600e-11 ***
C4                0.00      0.0000
VAm:C1           18.83      8.7046    2.1636 0.0336791 *
VAm:C2           33.33      8.7046    3.8294 0.0002645 ***
VAm:C3            0.50      8.7046    0.0574 0.9543466
VAm:C4            0.00      0.0000
VCo:C1           -9.17      8.7046   -1.0531 0.2956825
VCo:C2          -15.50      8.7046   -1.7807 0.0790155 .
VCo:C3          -13.33      8.7046   -1.5318 0.1297887
VCo:C4            0.00      0.0000
VFe:C1            1.33      8.7046    0.1532 0.8786707
VFe:C2            5.67      8.7046    0.6510 0.5170370
VFe:C3            8.17      8.7046    0.9382 0.3511512
VFe:C4            0.00      0.0000
VHa:C1            0.00      8.7046    0.0000 1.0000000
VHa:C2           -8.00      8.7046   -0.9191 0.3610122
VHa:C3           -7.50      8.7046   -0.8616 0.3916454
VHa:C4            0.00      0.0000
VPi:C1            0.00      0.0000
VPi:C2            0.00      0.0000
VPi:C3            0.00      0.0000
VPi:C4            0.00      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.6.4 p444

(122) MODEL

```
v1p444 = v1p432[v1p432$Block==5,]
GLM(Y ~ V + A + B + A:B + V:A, v1p444) # OK
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value     Pr(>F)
MODEL           11  39278  3570.8  59.787 1.897e-06 ***
RESIDUALS        8    478    59.7
CORRECTED TOTAL 19  39756
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
    Df  Sum Sq Mean Sq  F value     Pr(>F)
V    4 19287.7  4821.9  80.7355 1.674e-06 ***
A    1  3380.0  3380.0  56.5927 6.780e-05 ***
B    1 14045.0 14045.0 235.1612 3.247e-07 ***
A:B  1   115.2   115.2   1.9288  0.202326
V:A  4  2450.5   612.6  10.2574  0.003081 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
    Df  Sum Sq Mean Sq  F value     Pr(>F)
V    4 19287.7  4821.9  80.7355 1.674e-06 ***
A    1  3380.0  3380.0  56.5927 6.780e-05 ***
B    1 14045.0 14045.0 235.1612 3.247e-07 ***
A:B  1   115.2   115.2   1.9288  0.202326
V:A  4  2450.5   612.6  10.2574  0.003081 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
    Df  Sum Sq Mean Sq  F value     Pr(>F)
V    4 19287.7  4821.9  80.7355 1.674e-06 ***
A    1  3380.0  3380.0  56.5927 6.780e-05 ***
B    1 14045.0 14045.0 235.1612 3.247e-07 ***
A:B  1   115.2   115.2   1.9288  0.202326
V:A  4  2450.5   612.6  10.2574  0.003081 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error  t value  Pr(>|t|)
(Intercept)    720.1     5.9862 120.2927 2.554e-14 ***
VAm           -107.0     7.7282 -13.8454 7.159e-07 ***
VCo            -57.0     7.7282  -7.3756 7.800e-05 ***
```

```
VFe              -32.5       7.7282   -4.2054   0.002975  **
VHa              -65.0       7.7282   -8.4108  3.040e-05  ***
VPi                0.0       0.0000
AF               -28.2       8.4658   -3.3310   0.010368  *
AM                 0.0       0.0000
BH               -48.2       4.8877   -9.8614  9.419e-06  ***
BL                 0.0       0.0000
AF:BH             -9.6       6.9123   -1.3888   0.202326
AF:BL              0.0       0.0000
AM:BH              0.0       0.0000
AM:BL              0.0       0.0000
VAm:AF            42.5      10.9293    3.8886   0.004618  **
VAm:AM             0.0       0.0000
VCo:AF            17.0      10.9293    1.5554   0.158449
VCo:AM             0.0       0.0000
VFe:AF             0.0      10.9293    0.0000   1.000000
VFe:AM             0.0       0.0000
VHa:AF           -24.5      10.9293   -2.2417   0.055281  .
VHa:AM             0.0       0.0000
VPi:AF             0.0       0.0000
VPi:AM             0.0       0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.6.5 p482

(123) MODEL

```
v1p482 = read.table("C:/G/Rt/Kemp/v1p482.txt", head=TRUE)
v1p482 = af(v1p482,c("block", "A", "B"))
GLM(y ~ block + A + B + A:B, v1p482) # OK
```

```
$ANOVA
Response : y
                Df  Sum Sq  Mean Sq  F value     Pr(>F)
MODEL            8  156.88  19.6094   9.8871  9.377e-05  ***
RESIDUALS       15   29.75   1.9833
CORRECTED TOTAL 23  186.62
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
        Df  Sum Sq  Mean Sq  F value     Pr(>F)
block    5  108.38   21.675  10.9286  0.0001415  ***
A        1    4.00    4.000   2.0168  0.1760166
B        1   42.25   42.250  21.3025  0.0003365  ***
```

```
A:B    1   2.25   2.250  1.1345 0.3036727
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
block  5 31.417   6.283  3.1681 0.0377804 *
A      1  4.000   4.000  2.0168 0.1760166
B      1 42.250  42.250 21.3025 0.0003365 ***
A:B    1  2.250   2.250  1.1345 0.3036727
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
block  5 31.417   6.283  3.1681 0.0377804 *
A      1  4.000   4.000  2.0168 0.1760166
B      1 42.250  42.250 21.3025 0.0003365 ***
A:B    1  2.250   2.250  1.1345 0.3036727
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)    9.000    0.86241 10.4359 2.842e-08 ***
block1        -1.375    1.11337 -1.2350   0.23583
block2         1.125    1.11337  1.0104   0.32830
block3        -0.125    1.11337 -0.1123   0.91210
block4         2.875    1.11337  2.5823   0.02082 *
block5         1.250    1.21963  1.0249   0.32166
block6         0.000    0.00000
A0            -0.250    0.99582 -0.2510   0.80518
A1             0.000    0.00000
B0            -2.500    0.99582 -2.5105   0.02400 *
B1             0.000    0.00000
A0:B0         -1.500    1.40831 -1.0651   0.30367
A0:B1          0.000    0.00000
A1:B0          0.000    0.00000
A1:B1          0.000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.7   Chapter 12

8.7.1   p525

(124) MODEL

```
v1p525 = read.table("C:/G/Rt/Kemp/v1p525.txt", head=TRUE)
REG(y ~ x1 + x2 + x3, v1p525)
```

```
            Estimate Std. Error  t value  Pr(>|t|)
(Intercept)  14.2125    0.10383 136.8787 < 2.2e-16 ***
x1            0.7875    0.10383   7.5843 6.465e-06 ***
x2            1.3875    0.10383  13.3628 1.446e-08 ***
x3            1.6625    0.10383  16.0113 1.839e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
GLM(y ~ x1 + x2 + x3, v1p525) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value   Pr(>F)
MODEL            3 84.948 28.3158  164.15 5.26e-10 ***
RESIDUALS       12  2.070  0.1725
CORRECTED TOTAL 15 87.017
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
   Df Sum Sq Mean Sq F value     Pr(>F)
x1  1  9.923   9.923  57.522 6.465e-06 ***
x2  1 30.803  30.803 178.565 1.446e-08 ***
x3  1 44.223  44.223 256.362 1.839e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
   Df Sum Sq Mean Sq F value     Pr(>F)
x1  1  9.923   9.923  57.522 6.465e-06 ***
x2  1 30.803  30.803 178.565 1.446e-08 ***
x3  1 44.223  44.223 256.362 1.839e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
   Df Sum Sq Mean Sq F value     Pr(>F)
x1  1  9.923   9.923  57.522 6.465e-06 ***
x2  1 30.803  30.803 178.565 1.446e-08 ***
x3  1 44.223  44.223 256.362 1.839e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
            Estimate Std. Error  t value  Pr(>|t|)
(Intercept)  14.2125    0.10383 136.8787 < 2.2e-16 ***
x1            0.7875    0.10383   7.5843 6.465e-06 ***
x2            1.3875    0.10383  13.3628 1.446e-08 ***
x3            1.6625    0.10383  16.0113 1.839e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.7.2 p527

(125) MODEL

```
v1p527 = read.table("C:/G/Rt/Kemp/v1p527.txt", head=TRUE)
GLM(y ~ A + B, v1p527) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value  Pr(>F)
MODEL            2  22.99 11.4952  4.8917 0.04686 *
RESIDUALS        7  16.45  2.3499
CORRECTED TOTAL  9  39.44
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
  Df Sum Sq Mean Sq F value  Pr(>F)
A  1 10.364  10.364  4.4103 0.07386 .
B  1 12.626  12.626  5.3730 0.05355 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
  Df Sum Sq Mean Sq F value  Pr(>F)
A  1 10.364  10.364  4.4103 0.07386 .
B  1 12.626  12.626  5.3730 0.05355 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
  Df Sum Sq Mean Sq F value  Pr(>F)
A  1 10.364  10.364  4.4103 0.07386 .
B  1 12.626  12.626  5.3730 0.05355 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   5.2000     0.48476 10.7269 1.345e-05 ***
A             1.1439     0.54471  2.1001   0.07386 .
B             1.2626     0.54471  2.3180   0.05355 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.7.3 p529

(126) MODEL

```
v1p529 = read.table("C:/G/Rt/Kemp/v1p529.txt", head=TRUE)
GLM(y ~ A + B + I(A*A) + I(B*B) + I(A*B), v1p529) # OK
```

```
$ANOVA
Response : y
                 Df Sum Sq Mean Sq F value  Pr(>F)
MODEL             5 35.713  7.1427  6.7928 0.01857 *
RESIDUALS         6  6.309  1.0515
CORRECTED TOTAL  11 42.023
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
          Df  Sum Sq Mean Sq F value  Pr(>F)
A          1 11.6012 11.6012 11.0329 0.01597 *
B          1 12.6263 12.6263 12.0077 0.01338 *
I(A * A)   1  1.7167  1.7167  1.6326 0.24855
I(B * B)   1  5.3593  5.3593  5.0967 0.06476 .
I(A * B)   1  4.4100  4.4100  4.1940 0.08649 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
          Df  Sum Sq Mean Sq F value  Pr(>F)
A          1 11.6012 11.6012 11.0329 0.01597 *
B          1 12.6263 12.6263 12.0077 0.01338 *
I(A * A)   1  5.5468  5.5468  5.2750 0.06137 .
I(B * B)   1  5.3593  5.3593  5.0967 0.06476 .
I(A * B)   1  4.4100  4.4100  4.1940 0.08649 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
          Df  Sum Sq Mean Sq F value  Pr(>F)
```

```
A          1 11.6012 11.6012 11.0329 0.01597 *
B          1 12.6263 12.6263 12.0077 0.01338 *
I(A * A)   1  5.5468  5.5468  5.2750 0.06137 .
I(B * B)   1  5.3593  5.3593  5.0967 0.06476 .
I(A * B)   1  4.4100  4.4100  4.1940 0.08649 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.5625    0.72492  4.9144 0.002672 **
A             0.9899    0.29801  3.3216 0.015973 *
B             1.2626    0.36437  3.4652 0.013382 *
I(A * A)      1.0106    0.44003  2.2967 0.061374 .
I(B * B)      1.0838    0.48007  2.2576 0.064762 .
I(A * B)      1.0500    0.51272  2.0479 0.086491 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.8   Chapter 13

8.8.1   p563

(127) MODEL

```
v1p563 = read.table("C:/G/Rt/Kemp/v1p563.txt", head=TRUE)
v1p563 = af(v1p563, c("rep", "A", "B"))
GLM(y ~ rep + A + rep:A + B + A:B, v1p563) # OK
```

```
$ANOVA
Response : y
                 Df  Sum Sq Mean Sq F value     Pr(>F)
MODEL            14 2097.08 149.792  17.228 8.385e-05 ***
RESIDUALS         9   78.25   8.694
CORRECTED TOTAL  23 2175.33
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
      Df  Sum Sq Mean Sq F value     Pr(>F)
rep    3 1241.00  413.67 47.5783 7.606e-06 ***
A      2  353.08  176.54 20.3051 0.0004613 ***
rep:A  6  192.25   32.04  3.6853 0.0393557 *
B      1  216.00  216.00 24.8435 0.0007550 ***
A:B    2   94.75   47.38  5.4489 0.0281496 *
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
      Df  Sum Sq Mean Sq F value     Pr(>F)
rep    3 1241.00  413.67 47.5783 7.606e-06 ***
A      2  353.08  176.54 20.3051 0.0004613 ***
rep:A  6  192.25   32.04  3.6853 0.0393557 *
B      1  216.00  216.00 24.8435 0.0007550 ***
A:B    2   94.75   47.38  5.4489 0.0281496 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
      Df  Sum Sq Mean Sq F value     Pr(>F)
rep    3 1241.00  413.67 47.5783 7.606e-06 ***
A      2  353.08  176.54 20.3051 0.0004613 ***
rep:A  6  192.25   32.04  3.6853 0.0393557 *
B      1  216.00  216.00 24.8435 0.0007550 ***
A:B    2   94.75   47.38  5.4489 0.0281496 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   17.250     2.3311  7.3999 4.104e-05 ***
rep1          19.500     2.9486  6.6132 9.778e-05 ***
rep2          14.000     2.9486  4.7480  0.001047 **
rep3          -0.500     2.9486 -0.1696  0.869099
rep4           0.000     0.0000
A1             5.375     3.2967  1.6304  0.137448
A2            11.375     3.2967  3.4504  0.007270 **
A3             0.000     0.0000
rep1:A1        1.500     4.1700  0.3597  0.727358
rep1:A2       -9.000     4.1700 -2.1583  0.059234 .
rep1:A3        0.000     0.0000
rep2:A1      -11.000     4.1700 -2.6379  0.027007 *
rep2:A2      -14.500     4.1700 -3.4772  0.006969 **
rep2:A3        0.000     0.0000
rep3:A1        1.000     4.1700  0.2398  0.815851
rep3:A2       -3.000     4.1700 -0.7194  0.490137
rep3:A3        0.000     0.0000
rep4:A1        0.000     0.0000
rep4:A2        0.000     0.0000
rep4:A3        0.000     0.0000
B1             0.500     2.0850  0.2398  0.815851
B2             0.000     0.0000
A1:B1          9.250     2.9486  3.1370  0.011985 *
A1:B2          0.000     0.0000
```

```
A2:B1          7.250     2.9486  2.4588  0.036232 *
A2:B2          0.000     0.0000
A3:B1          0.000     0.0000
A3:B2          0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.8.2 p566

(128) MODEL

```
v1p566 = read.table("C:/G/Rt/Kemp/v1p566.txt", head=TRUE)
v1p566 = af(v1p566, c("subject", "A", "B"))
GLM(y ~ A + B + A:B, v1p566) # OK
```

```
$ANOVA
Response : y
                Df  Sum Sq Mean Sq F value     Pr(>F)
MODEL            5 1469.58  293.92    86.2 5.592e-09 ***
RESIDUALS       12   40.92    3.41
CORRECTED TOTAL 17 1510.50
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
    Df  Sum Sq Mean Sq  F value      Pr(>F)
A    2 1390.04  695.02 203.8350 5.466e-10 ***
B    1   76.06   76.06  22.3055 0.0004945 ***
A:B  2    3.49    1.74   0.5112 0.6122667
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
    Df  Sum Sq Mean Sq  F value     Pr(>F)
A    2 1390.04  695.02 203.8350 5.466e-10 ***
B    1   76.06   76.06  22.3055 0.0004945 ***
A:B  2    3.49    1.74   0.5112 0.6122667
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
    Df  Sum Sq Mean Sq  F value     Pr(>F)
A    2 1390.04  695.02 203.8350 5.466e-10 ***
B    1   79.00   79.00  23.1700 0.0004237 ***
A:B  2    3.49    1.74   0.5112 0.6122667
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error   t value   Pr(>|t|)
(Intercept)   54.500     1.3057   41.7400  2.309e-14 ***
A1           -23.750     1.5992  -14.8516  4.354e-09 ***
A2           -18.167     1.6857  -10.7772  1.586e-07 ***
A3             0.000     0.0000
B1            -5.500     1.8465   -2.9785    0.01152 *
B2             0.000     0.0000
A1:B1          2.250     2.2615    0.9949    0.33943
A1:B2          0.000     0.0000
A2:B1          1.167     2.3839    0.4894    0.63338
A2:B2          0.000     0.0000
A3:B1          0.000     0.0000
A3:B2          0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.9   Chapter 14

8.9.1   p581

(129) MODEL

```
v1p581 = read.table("C:/G/Rt/Kemp/v1p581.txt", head=TRUE)
v1p581 = af(v1p581, c("drug", "person", "time"))
GLM(rate ~ drug + person:drug + time + drug:time, v1p581) # OK
```

```
$ANOVA
Response : rate
                Df Sum Sq Mean Sq F value     Pr(>F)
MODEL           23 2449.5 106.500  12.733 3.469e-11 ***
RESIDUALS       36  301.1   8.364
CORRECTED TOTAL 59 2750.6
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
            Df  Sum Sq Mean Sq F value     Pr(>F)
drug         2  337.60 168.800 20.1820 1.323e-06 ***
drug:person 12 1498.50 124.875 14.9303 1.501e-10 ***
time         3  256.33  85.444 10.2159 5.230e-05 ***
drug:time    6  357.07  59.511  7.1152 4.707e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
            Df  Sum Sq Mean Sq F value    Pr(>F)
drug         2  337.60 168.800 20.1820 1.323e-06 ***
drug:person 12 1498.50 124.875 14.9303 1.501e-10 ***
time         3  256.33  85.444 10.2159 5.230e-05 ***
drug:time    6  357.07  59.511  7.1152 4.707e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
            Df  Sum Sq Mean Sq F value    Pr(>F)
drug         2  337.60 168.800 20.1820 1.323e-06 ***
drug:person 12 1498.50 124.875 14.9303 1.501e-10 ***
time         3  256.33  85.444 10.2159 5.230e-05 ***
drug:time    6  357.07  59.511  7.1152 4.707e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
              Estimate Std. Error t value  Pr(>|t|)
(Intercept)      71.05     1.8291 38.8445 < 2.2e-16 ***
drug1            -2.95     2.5867 -1.1404  0.261633
drug2             8.20     2.5867  3.1700  0.003108 **
drug3             0.00     0.0000
drug1:person1     7.00     2.0450  3.4230  0.001559 **
drug1:person2    10.50     2.0450  5.1345 9.954e-06 ***
drug1:person3     5.25     2.0450  2.5673  0.014551 *
drug1:person4     4.75     2.0450  2.3228  0.025959 *
drug1:person5     0.00     0.0000
drug2:person1     2.75     2.0450  1.3448  0.187116
drug2:person2     2.25     2.0450  1.1003  0.278524
drug2:person3    -7.25     2.0450 -3.5453  0.001109 **
drug2:person4     2.00     2.0450  0.9780  0.334599
drug2:person5     0.00     0.0000
drug3:person1     1.25     2.0450  0.6113  0.544873
drug3:person2    -3.75     2.0450 -1.8338  0.074968 .
drug3:person3    16.50     2.0450  8.0685 1.374e-09 ***
drug3:person4     6.75     2.0450  3.3008  0.002182 **
drug3:person5     0.00     0.0000
time1            -1.00     1.8291 -0.5467  0.587943
time2             0.40     1.8291  0.2187  0.828128
time3            -0.60     1.8291 -0.3280  0.744787
time4             0.00     0.0000
drug1:time1      -0.80     2.5867 -0.3093  0.758897
drug1:time2       8.60     2.5867  3.3247  0.002044 **
drug1:time3       9.00     2.5867  3.4793  0.001334 **
drug1:time4       0.00     0.0000
```

```
drug2:time1        3.20      2.5867  1.2371  0.224063
drug2:time2        5.00      2.5867  1.9330  0.061138 .
drug2:time3       -1.00      2.5867 -0.3866  0.701335
drug2:time4        0.00      0.0000
drug3:time1        0.00      0.0000
drug3:time2        0.00      0.0000
drug3:time3        0.00      0.0000
drug3:time4        0.00      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9 Hinkelmann & Kempthorne - Volume 2

Reference - Hinkelmann K, Kempthorne O. Design and Analysis of Experiments Volume 2 Advanced Experimental Design. 2e. John Wiley & Sons Inc. 2008.

9.1 Chapter 1

9.1.1 p53

(130) MODEL

```
v2p53 = read.table("C:/G/Rt/Kemp/v2p53.txt", head=TRUE)
v2p53 = af(v2p53, c("TRT", "BLOCK"))
GLM(Y ~ BLOCK + TRT, v2p53) # OK
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL            7 518.21  74.030  8.1408 0.1137
RESIDUALS        2  18.19   9.094
CORRECTED TOTAL  9 536.40

$`Type I`
      Df Sum Sq Mean Sq F value  Pr(>F)
BLOCK  4 261.40  65.350  7.1863 0.12587
TRT    3 256.81  85.604  9.4135 0.09755 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
      Df  Sum Sq Mean Sq F value  Pr(>F)
BLOCK  4  79.146  19.786  2.1758 0.33880
TRT    3 256.812  85.604  9.4135 0.09755 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
      Df  Sum Sq Mean Sq F value  Pr(>F)
BLOCK  4  79.146  19.786  2.1758 0.33880
TRT    3 256.813  85.604  9.4135 0.09755 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  31.1250     2.6116 11.9181 0.006967 **
```

```
BLOCK1      -7.6875      3.4548 -2.2252 0.156028
BLOCK2      -4.0625      3.4548 -1.1759 0.360652
BLOCK3      -1.9375      3.4548 -0.5608 0.631370
BLOCK4      -9.3125      3.4548 -2.6955 0.114475
BLOCK5       0.0000      0.0000
TRT1       -15.2500      3.0156 -5.0571 0.036949 *
TRT2        -9.6250      3.3715 -2.8548 0.103924
TRT3        -3.1250      3.3715 -0.9269 0.451839
TRT4         0.0000      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.1.2 p62

(131) MODEL

```
GLM(Y ~ TRT + BLOCK, v2p53) # OK
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL            7 518.21  74.030  8.1408 0.1137
RESIDUALS        2  18.19   9.094
CORRECTED TOTAL  9 536.40


$`Type I`
      Df Sum Sq Mean Sq F value  Pr(>F)
TRT    3 439.07 146.356 16.0941 0.05907 .
BLOCK  4  79.15  19.786  2.1758 0.33880
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
      Df  Sum Sq Mean Sq F value  Pr(>F)
TRT    3 256.812  85.604  9.4135 0.09755 .
BLOCK  4  79.146  19.786  2.1758 0.33880
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
      Df  Sum Sq Mean Sq F value  Pr(>F)
TRT    3 256.813  85.604  9.4135 0.09755 .
BLOCK  4  79.146  19.786  2.1758 0.33880
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  31.1250    2.6116 11.9181 0.006967 **
TRT1        -15.2500    3.0156 -5.0571 0.036949 *
TRT2         -9.6250    3.3715 -2.8548 0.103924
TRT3         -3.1250    3.3715 -0.9269 0.451839
TRT4          0.0000    0.0000
BLOCK1       -7.6875    3.4548 -2.2252 0.156028
BLOCK2       -4.0625    3.4548 -1.1759 0.360652
BLOCK3       -1.9375    3.4548 -0.5608 0.631370
BLOCK4       -9.3125    3.4548 -2.6955 0.114475
BLOCK5        0.0000    0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.2   Chapter 2

9.2.1   p82

(132) MODEL

```
v2p82 = read.table("C:/G/Rt/Kemp/v2p82.txt", head=TRUE)
v2p82 = af(v2p82, c("B", "Tx"))
GLM(Y ~ B + Tx, v2p82) # OK
```

```
$ANOVA
Response : Y
                Df  Sum Sq Mean Sq F value    Pr(>F)
MODEL           14  889.11  63.508  6.3183 0.000518 ***
RESIDUALS       15  150.77  10.052
CORRECTED TOTAL 29 1039.89
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
   Df Sum Sq Mean Sq F value     Pr(>F)
B   9 730.39  81.154  8.0738 0.0002454 ***
Tx  5 158.73  31.745  3.1583 0.0381655 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
   Df Sum Sq Mean Sq F value     Pr(>F)
B   9 595.74  66.193  6.5854 0.0007602 ***
Tx  5 158.73  31.745  3.1583 0.0381655 *
---
```

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
   Df Sum Sq Mean Sq F value   Pr(>F)
B   9 595.74 66.193 6.5854 0.0007602 ***
Tx 5 158.73 31.745 3.1583 0.0381655 *

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   31.833   2.5886 12.2974 3.091e-09 ***
B1   7.481   2.7960 2.6754 0.0172900 *
B10   10.778   2.7960 3.8547 0.0015590 **
B2   11.614   2.7960 4.1537 0.0008488 ***
B3   5.678   2.7960 2.0306 0.0604081 .
B4   16.275   2.7960 5.8207 3.370e-05 ***
B5   9.786   2.6943 3.6321 0.0024584 **
B6   12.889   2.6943 4.7837 0.0002415 ***
B7   13.258   2.6943 4.9208 0.0001847 ***
B8   16.908   2.7960 6.0472 2.234e-05 ***
B9   0.000   0.0000
Tx1   -3.300   2.2418 -1.4720 0.1616856
Tx2   -5.042   2.2418 -2.2489 0.0399711 *
Tx3   -2.900   2.2418 -1.2936 0.2153725
Tx4   -3.233   2.2418 -1.4423 0.1697778
Tx5   -8.525   2.2418 -3.8027 0.0017336 **
Tx6   0.000   0.0000

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

9.2.2 p87

(133) MODEL

```
v2p87 = read.table("C:/G/Rt/Kemp/v2p87.txt", head=TRUE)
GLM(y ~ x1 + x2 + x3 + x4 + x5 + x6, v2p87) # OK
```

$ANOVA
Response : y
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL   5 1613.25 322.65 2.2332 0.2282
RESIDUALS   4 577.91 144.48
CORRECTED TOTAL 9 2191.16

$`Type I`

```
   Df  Sum Sq Mean Sq F value  Pr(>F)
x1  1 1044.48 1044.48  7.2293 0.05473 .
x2  1   89.79   89.79  0.6215 0.47459
x3  1   10.45   10.45  0.0724 0.80124
x4  1  407.08  407.08  2.8176 0.16854
x5  1   61.44   61.44  0.4253 0.54990
x6  0
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
   Df Sum Sq Mean Sq F value Pr(>F)
x1  0
x2  0
x3  0
x4  0
x5  0
x6  0


$`Type III`
CAUTION: Singularity Exists !
   Df Sum Sq Mean Sq F value Pr(>F)
x1  0
x2  0
x3  0
x4  0
x5  0
x6  0


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  131.100    19.3815  6.7642 0.002492 **
x1            11.800     9.8142  1.2023 0.295540
x2           -13.533     9.8142 -1.3790 0.239998
x3            -5.800     9.8142 -0.5910 0.586312
x4           -17.467     9.8142 -1.7797 0.149731
x5            -6.400     9.8142 -0.6521 0.549902
x6             0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.3 Chapter 6

9.3.1 p217

(134) MODEL

```
v2p217 = read.table("C:/G/Rt/Kemp/v2p217.txt", head=TRUE)
v2p217 = af(v2p217, c("R", "C", "Tx"))
GLM(Y ~ R + C + Tx, v2p217) # OK
```

$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value   Pr(>F)
MODEL   22 4305.1 195.687 7.5094 0.0002682 ***
RESIDUALS   13 338.8 26.059
CORRECTED TOTAL 35 4643.9

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
   Df Sum Sq Mean Sq F value   Pr(>F)
R   3 3951.4 1317.15 50.5446 1.998e-07 ***
C   8 168.9   21.11 0.8101   0.6062
Tx 11 184.8   16.80 0.6446   0.7638

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
   Df Sum Sq Mean Sq F value   Pr(>F)
R   3 3403.5 1134.51 43.5360 4.83e-07 ***
C   8 112.4   14.05 0.5390   0.8077
Tx 11 184.8   16.80 0.6446   0.7638

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
   Df Sum Sq Mean Sq F value   Pr(>F)
R   3 3403.5 1134.51 43.5360 4.83e-07 ***
C   8 112.4   14.05 0.5390   0.8077
Tx 11 184.8   16.80 0.6446   0.7638

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   40.667   4.7371   8.5848 1.024e-06 ***
R1   -25.542   2.5524 -10.0069 1.785e-07 ***
R2   -24.167   2.5524 -9.4682 3.379e-07 ***
R3   -12.458   2.5524 -4.8810 0.0003001 ***
R4   0.000   0.0000
C1   3.000   4.1681   0.7198 0.4844133
C2   1.444   4.1681   0.3466 0.7344740
C3   5.000   4.1681   1.1996 0.2517026
```

```
C4              1.556      4.1681    0.3732 0.7150083
C5              0.778      4.1681    0.1866 0.8548516
C6              6.333      4.1681    1.5195 0.1525804
C7              2.889      4.1681    0.6931 0.5004420
C8              5.000      4.1681    1.1996 0.2517026
C9              0.000      0.0000
Tx1             0.111      4.8129    0.0231 0.9819321
Tx10            1.986      4.6859    0.4239 0.6786025
Tx11           -5.838      4.6859   -1.2459 0.2347984
Tx12           -6.458      4.6859   -1.3783 0.1913817
Tx2             0.940      4.6859    0.2006 0.8441430
Tx3             0.273      4.6859    0.0583 0.9544025
Tx4            -1.093      4.6859   -0.2332 0.8192619
Tx5            -1.981      4.6859   -0.4229 0.6793051
Tx6             2.097      4.6859    0.4476 0.6618344
Tx7            -0.111      4.8129   -0.0231 0.9819321
Tx8            -1.426      4.6859   -0.3043 0.7657124
Tx9             0.000      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.3.2 p234

(135) MODEL

```
v2p234 = read.table("C:/G/Rt/Kemp/v2p234.txt", head=TRUE)
v2p234 = af(v2p234, c("R", "C", "Tx"))
GLM(Y ~ C + R + Tx, v2p234) # OK
```

```
$ANOVA
Response : Y
               Df Sum Sq Mean Sq F value Pr(>F)
MODEL          13 426.50  32.808  7.0936 0.1302
RESIDUALS       2   9.25   4.625
CORRECTED TOTAL 15 435.75

$`Type I`
   Df Sum Sq Mean Sq F value  Pr(>F)
C   3  16.25   5.417  1.1712 0.49129
R   3 357.25 119.083 25.7477 0.03762 *
Tx  7  53.00   7.571  1.6371 0.43052
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
   Df Sum Sq Mean Sq F value Pr(>F)
```

```
C   3  10.25   3.417  0.7387 0.6189
R   3 285.50  95.167 20.5766 0.0467 *
Tx  7  53.00   7.571  1.6371 0.4305
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
   Df Sum Sq Mean Sq F value Pr(>F)
C   3  10.25   3.417  0.7387 0.6189
R   3 285.50  95.167 20.5766 0.0467 *
Tx  7  53.00   7.571  1.6371 0.4305
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   36.375     2.0117 18.0819 0.003045 **
C1             0.250     1.8625  0.1342 0.905509
C2             2.250     1.8625  1.2081 0.350481
C3             0.000     2.1506  0.0000 1.000000
C4             0.000     0.0000
R1            -9.500     1.8625 -5.1008 0.036352 *
R2            -6.000     1.8625 -3.2215 0.084343 .
R3             1.000     2.1506  0.4650 0.687652
R4             0.000     0.0000
Tx1           -6.250     2.6339 -2.3729 0.140990
Tx2           -6.750     2.8449 -2.3726 0.141016
Tx3           -1.500     2.6339 -0.5695 0.626456
Tx4           -3.000     2.4044 -1.2477 0.338419
Tx5           -2.750     2.8449 -0.9666 0.435712
Tx6           -5.250     2.6339 -1.9932 0.184428
Tx7           -4.500     2.8449 -1.5817 0.254516
Tx8            0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.4   Chapter 7

9.4.1   p268

(136) MODEL

```
v2p268 = read.table("C:/G/Rt/Kemp/v2p268.txt", head=TRUE)
v2p268 = af(v2p268, c("A", "B", "C"))
GLM(y ~ block + A*B*C, v2p268) # OK
```


$ANOVA

```
Response : y
                Df  Sum Sq Mean Sq F value    Pr(>F)
MODEL            8 1026.00 128.250  24.981 0.0001765 ***
RESIDUALS        7   35.94   5.134
CORRECTED TOTAL 15 1061.94
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
      Df Sum Sq Mean Sq  F value    Pr(>F)
block  1 715.56  715.56 139.3791 7.093e-06 ***
A      1  68.06   68.06  13.2574 0.0082753 **
B      1   0.06    0.06   0.0122 0.9152401
A:B    1   0.56    0.56   0.1096 0.7503276
C      1 232.56  232.56  45.2991 0.0002698 ***
A:C    1   0.06    0.06   0.0122 0.9152401
B:C    1   7.56    7.56   1.4730 0.2642229
A:B:C  1   1.56    1.56   0.3043 0.5983312
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
      Df Sum Sq Mean Sq  F value    Pr(>F)
block  1 715.56  715.56 139.3791 7.093e-06 ***
A      1  68.06   68.06  13.2574 0.0082753 **
B      1   0.06    0.06   0.0122 0.9152401
A:B    1   0.56    0.56   0.1096 0.7503276
C      1 232.56  232.56  45.2991 0.0002698 ***
A:C    1   0.06    0.06   0.0122 0.9152401
B:C    1   7.56    7.56   1.4730 0.2642229
A:B:C  1   1.56    1.56   0.3043 0.5983312
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
      Df Sum Sq Mean Sq  F value    Pr(>F)
block  1 715.56  715.56 139.3791 7.093e-06 ***
A      1  68.06   68.06  13.2574 0.0082753 **
B      1   0.06    0.06   0.0122 0.9152401
A:B    1   0.56    0.56   0.1096 0.7503276
C      1 232.56  232.56  45.2991 0.0002698 ***
A:C    1   0.06    0.06   0.0122 0.9152401
B:C    1   7.56    7.56   1.4730 0.2642229
A:B:C  1   1.56    1.56   0.3043 0.5983312
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
```

```
           Estimate Std. Error t value  Pr(>|t|)
(Intercept)  10.938     2.3356  4.6830  0.002253 **
block        13.375     1.1329 11.8059 7.093e-06 ***
A0           -4.500     2.2658 -1.9860  0.087400 .
A1            0.000     0.0000
B0            1.000     2.2658  0.4413  0.672276
B1            0.000     0.0000
A0:B0         0.500     3.2043  0.1560  0.880408
A0:B1         0.000     0.0000
A1:B0         0.000     0.0000
A1:B1         0.000     0.0000
C0           -7.000     2.2658 -3.0894  0.017582 *
C1            0.000     0.0000
A0:C0         1.500     3.2043  0.4681  0.653929
A0:C1         0.000     0.0000
A1:C0         0.000     0.0000
A1:C1         0.000     0.0000
B0:C0        -1.500     3.2043 -0.4681  0.653929
B0:C1         0.000     0.0000
B1:C0         0.000     0.0000
B1:C1         0.000     0.0000
A0:B0:C0     -2.500     4.5316 -0.5517  0.598331
A0:B0:C1      0.000     0.0000
A0:B1:C0      0.000     0.0000
A0:B1:C1      0.000     0.0000
A1:B0:C0      0.000     0.0000
A1:B0:C1      0.000     0.0000
A1:B1:C0      0.000     0.0000
A1:B1:C1      0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.4.2 p273

(137) MODEL

```
v2p273 = read.table("C:/G/Rt/Kemp/v2p273.txt", head=TRUE)
v2p273 = af(v2p273, c("block", "A", "B", "C"))
GLM(y ~ block + A*B*C + block:A:B:C, v2p273) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value     Pr(>F)
MODEL           15 2245.0 149.665  129.44 8.427e-14 ***
RESIDUALS       16   18.5   1.156
CORRECTED TOTAL 31 2263.5
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
             Df  Sum Sq Mean Sq   F value    Pr(>F)
block         1 1498.78 1498.78 1296.2432 < 2.2e-16 ***
A             1  132.03  132.03  114.1892 1.083e-08 ***
B             1    0.03    0.03    0.0270   0.87148
A:B           1    1.53    1.53    1.3243   0.26673
C             1  504.03  504.03  435.9189 4.926e-13 ***
A:C           1    0.78    0.78    0.6757   0.42316
B:C           1    3.78    3.78    3.2703   0.08938 .
A:B:C         1    2.53    2.53    2.1892   0.15840
block:A:B:C   7  101.47   14.50   12.5367 1.965e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
             Df  Sum Sq Mean Sq   F value    Pr(>F)
block         1 1498.78 1498.78 1296.2432 < 2.2e-16 ***
A             1  132.03  132.03  114.1892 1.083e-08 ***
B             1    0.03    0.03    0.0270   0.87148
A:B           1    1.53    1.53    1.3243   0.26673
C             1  504.03  504.03  435.9189 4.926e-13 ***
A:C           1    0.78    0.78    0.6757   0.42316
B:C           1    3.78    3.78    3.2703   0.08938 .
A:B:C         1    2.53    2.53    2.1892   0.15840
block:A:B:C   7  101.47   14.50   12.5367 1.965e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
             Df  Sum Sq Mean Sq   F value    Pr(>F)
block         1 1498.78 1498.78 1296.2432 < 2.2e-16 ***
A             1  132.03  132.03  114.1892 1.083e-08 ***
B             1    0.03    0.03    0.0270   0.87148
A:B           1    1.53    1.53    1.3243   0.26673
C             1  504.03  504.03  435.9189 4.926e-13 ***
A:C           1    0.78    0.78    0.6757   0.42316
B:C           1    3.78    3.78    3.2703   0.08938 .
A:B:C         1    2.53    2.53    2.1892   0.15840
block:A:B:C   7  101.47   14.50   12.5367 1.965e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error  t value  Pr(>|t|)
(Intercept)     41.0    0.76035  53.9229 < 2.2e-16 ***
```

```
block1              -18.5      1.07529 -17.2047 9.615e-12 ***
block2                0.0      0.00000
A0                   -6.5      1.07529  -6.0449 1.702e-05 ***
A1                    0.0      0.00000
B0                   -2.0      1.07529  -1.8600 0.0813758 .
B1                    0.0      0.00000
A0:B0                 3.5      1.52069   2.3016 0.0351358 *
A0:B1                 0.0      0.00000
A1:B0                 0.0      0.00000
A1:B1                 0.0      0.00000
C0                   -9.5      1.07529  -8.8348 1.495e-07 ***
C1                    0.0      0.00000
A0:C0                 2.5      1.52069   1.6440 0.1196805
A0:C1                 0.0      0.00000
A1:C0                 0.0      0.00000
A1:C1                 0.0      0.00000
B0:C0                -3.0      1.52069  -1.9728 0.0660548 .
B0:C1                 0.0      0.00000
B1:C0                 0.0      0.00000
B1:C1                 0.0      0.00000
A0:B0:C0             -1.0      2.15058  -0.4650 0.6482037
A0:B0:C1              0.0      0.00000
A0:B1:C0              0.0      0.00000
A0:B1:C1              0.0      0.00000
A1:B0:C0              0.0      0.00000
A1:B0:C1              0.0      0.00000
A1:B1:C0              0.0      0.00000
A1:B1:C1              0.0      0.00000
block1:A0:B0:C0       7.0      1.52069   4.6032 0.0002938 ***
block1:A0:B0:C1       4.0      1.52069   2.6304 0.0181818 *
block1:A0:B1:C0       3.5      1.52069   2.3016 0.0351358 *
block1:A0:B1:C1       3.5      1.52069   2.3016 0.0351358 *
block1:A1:B0:C0      13.0      1.52069   8.5487 2.321e-07 ***
block1:A1:B0:C1       3.5      1.52069   2.3016 0.0351358 *
block1:A1:B1:C0       4.0      1.52069   2.6304 0.0181818 *
block1:A1:B1:C1       0.0      0.00000
block2:A0:B0:C0       0.0      0.00000
block2:A0:B0:C1       0.0      0.00000
block2:A0:B1:C0       0.0      0.00000
block2:A0:B1:C1       0.0      0.00000
block2:A1:B0:C0       0.0      0.00000
block2:A1:B0:C1       0.0      0.00000
block2:A1:B1:C0       0.0      0.00000
block2:A1:B1:C1       0.0      0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.5   Chapter 8

9.5.1   p304

(138) MODEL

```
v2p304 = read.table("C:/G/Rt/Kemp/v2p304.txt", head=TRUE)
v2p304 = af(v2p304, c("rep", "block", "A", "B", "C"))
GLM(y ~ rep + block %in% rep + A*B*C - A:B:C, v2p304) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            9 699.06  77.674  248.56 5.096e-07 ***
RESIDUALS        6   1.88   0.312
CORRECTED TOTAL 15 700.94
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
          Df Sum Sq Mean Sq F value     Pr(>F)
rep        1 390.06  390.06  1248.2 3.428e-08 ***
rep:block  2   8.12    4.06    13.0 0.0065918 **
A          1  18.06   18.06    57.8 0.0002696 ***
B          1 175.56  175.56   561.8 3.702e-07 ***
A:B        1   0.06    0.06     0.2 0.6704121
C          1  68.06   68.06   217.8 6.083e-06 ***
A:C        1   0.06    0.06     0.2 0.6704121
B:C        1  39.06   39.06   125.0 3.056e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
          Df Sum Sq Mean Sq F value     Pr(>F)
rep        1 390.06  390.06  1248.2 3.428e-08 ***
rep:block  2   8.12    4.06    13.0 0.0065918 **
A          1  18.06   18.06    57.8 0.0002696 ***
B          1 175.56  175.56   561.8 3.702e-07 ***
A:B        1   0.06    0.06     0.2 0.6704121
C          1  68.06   68.06   217.8 6.083e-06 ***
A:C        1   0.06    0.06     0.2 0.6704121
B:C        1  39.06   39.06   125.0 3.056e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
          Df Sum Sq Mean Sq F value     Pr(>F)
```

```
rep        1 390.06  390.06  1248.2 3.428e-08 ***
rep:block  2   8.12    4.06    13.0 0.0065918 **
A          1  18.06   18.06    57.8 0.0002696 ***
B          1 175.56  175.56   561.8 3.702e-07 ***
A:B        1   0.06    0.06     0.2 0.6704121
C          1  68.06   68.06   217.8 6.083e-06 ***
A:C        1   0.06    0.06     0.2 0.6704121
B:C        1  39.06   39.06   125.0 3.056e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error  t value  Pr(>|t|)
(Intercept)   35.625    0.44194  80.6102 2.454e-10 ***
rep1         -10.250    0.39528 -25.9307 2.169e-07 ***
rep2           0.000    0.00000
rep1:block1    1.750    0.39528   4.4272  0.004436 **
rep1:block2    0.000    0.00000
rep1:block3    0.000    0.00000
rep1:block4    0.000    0.00000
rep2:block1    0.000    0.00000
rep2:block2    0.000    0.00000
rep2:block3    1.000    0.39528   2.5298  0.044690 *
rep2:block4    0.000    0.00000
A0            -2.375    0.48412  -4.9058  0.002695 **
A1             0.000    0.00000
B0            -9.875    0.48412 -20.3977 9.026e-07 ***
B1             0.000    0.00000
A0:B0          0.250    0.55902   0.4472  0.670412
A0:B1          0.000    0.00000
A1:B0          0.000    0.00000
A1:B1          0.000    0.00000
C0            -7.375    0.48412 -15.2337 5.051e-06 ***
C1             0.000    0.00000
A0:C0          0.250    0.55902   0.4472  0.670412
A0:C1          0.000    0.00000
A1:C0          0.000    0.00000
A1:C1          0.000    0.00000
B0:C0          6.250    0.55902  11.1803 3.056e-05 ***
B0:C1          0.000    0.00000
B1:C0          0.000    0.00000
B1:C1          0.000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.5.2 p309

(139) MODEL

```
GLM(y ~ rep*A*B*C, v2p304) # OK
```

```
$ANOVA
Response : y
                 Df Sum Sq Mean Sq F value Pr(>F)
MODEL            15 700.94  46.729
RESIDUALS         0   0.00
CORRECTED TOTAL  15 700.94

$`Type I`
          Df Sum Sq Mean Sq F value Pr(>F)
rep        1 390.06  390.06
A          1  18.06   18.06
rep:A      1   0.06    0.06
B          1 175.56  175.56
rep:B      1   1.56    1.56
A:B        1   0.06    0.06
rep:A:B    1   0.06    0.06
C          1  68.06   68.06
rep:C      1   0.06    0.06
A:C        1   0.06    0.06
rep:A:C    1   0.06    0.06
B:C        1  39.06   39.06
rep:B:C    1   0.06    0.06
A:B:C      1   7.56    7.56
rep:A:B:C  1   0.56    0.56

$`Type II`
          Df Sum Sq Mean Sq F value Pr(>F)
rep        1 390.06  390.06
A          1  18.06   18.06
rep:A      1   0.06    0.06
B          1 175.56  175.56
rep:B      1   1.56    1.56
A:B        1   0.06    0.06
rep:A:B    1   0.06    0.06
C          1  68.06   68.06
rep:C      1   0.06    0.06
A:C        1   0.06    0.06
rep:A:C    1   0.06    0.06
B:C        1  39.06   39.06
rep:B:C    1   0.06    0.06
A:B:C      1   7.56    7.56
```

```
rep:A:B:C  1   0.56    0.56
```

$`Type III`
```
         Df Sum Sq Mean Sq F value Pr(>F)
rep        1 390.06  390.06
A          1  18.06   18.06
rep:A      1   0.06    0.06
B          1 175.56  175.56
rep:B      1   1.56    1.56
A:B        1   0.06    0.06
rep:A:B    1   0.06    0.06
C          1  68.06   68.06
rep:C      1   0.06    0.06
A:C        1   0.06    0.06
rep:A:C    1   0.06    0.06
B:C        1  39.06   39.06
rep:B:C    1   0.06    0.06
A:B:C      1   7.56    7.56
rep:A:B:C  1   0.56    0.56
```

$Parameter
```
            Estimate Std. Error t value Pr(>|t|)
(Intercept)       35
rep1              -9
rep2               0
A0                -1
A1                 0
rep1:A0            0
rep1:A1            0
rep2:A0            0
rep2:A1            0
B0                -8
B1                 0
rep1:B0           -1
rep1:B1            0
rep2:B0            0
rep2:B1            0
A0:B0             -2
A0:B1              0
A1:B0              0
A1:B1              0
rep1:A0:B0        -1
rep1:A0:B1         0
rep1:A1:B0         0
rep1:A1:B1         0
rep2:A0:B0         0
rep2:A0:B1         0
rep2:A1:B0         0
```

```
rep2:A1:B1              0
C0                     -6
C1                      0
rep1:C0                 0
rep1:C1                 0
rep2:C0                 0
rep2:C1                 0
A0:C0                  -2
A0:C1                   0
A1:C0                   0
A1:C1                   0
rep1:A0:C0             -1
rep1:A0:C1              0
rep1:A1:C0              0
rep1:A1:C1              0
rep2:A0:C0              0
rep2:A0:C1              0
rep2:A1:C0              0
rep2:A1:C1              0
B0:C0                   4
B0:C1                   0
B1:C0                   0
B1:C1                   0
rep1:B0:C0             -1
rep1:B0:C1              0
rep1:B1:C0              0
rep1:B1:C1              0
rep2:B0:C0              0
rep2:B0:C1              0
rep2:B1:C0              0
rep2:B1:C1              0
A0:B0:C0                4
A0:B0:C1                0
A0:B1:C0                0
A0:B1:C1                0
A1:B0:C0                0
A1:B0:C1                0
A1:B1:C0                0
A1:B1:C1                0
rep1:A0:B0:C0           3
rep1:A0:B0:C1           0
rep1:A0:B1:C0           0
rep1:A0:B1:C1           0
rep1:A1:B0:C0           0
rep1:A1:B0:C1           0
rep1:A1:B1:C0           0
rep1:A1:B1:C1           0
rep2:A0:B0:C0           0
```

```
rep2:A0:B0:C1          0
rep2:A0:B1:C0          0
rep2:A0:B1:C1          0
rep2:A1:B0:C0          0
rep2:A1:B0:C1          0
rep2:A1:B1:C0          0
rep2:A1:B1:C1          0
```

9.6   Chapter 9

9.6.1   p343

(140) MODEL

```
v2p343 = read.table("C:/G/Rt/Kemp/v2p343.txt", head=TRUE)
v2p343 = af(v2p343, c("rep", "block", "A", "B", "C"))
GLM(y ~ rep + block %in% rep + A*B*C - A:B:C, v2p343) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value   Pr(>F)
MODEL           17 1889.8 111.167  14.659 0.001608 **
RESIDUALS        6   45.5   7.583
CORRECTED TOTAL 23 1935.3
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
          Df  Sum Sq Mean Sq  F value    Pr(>F)
rep        2 1537.33  768.67 101.3626 2.375e-05 ***
rep:block  9  127.00   14.11   1.8608   0.23163
A          1   36.00   36.00   4.7473   0.07218 .
B          1   36.00   36.00   4.7473   0.07218 .
A:B        1   12.25   12.25   1.6154   0.25079
C          1   56.25   56.25   7.4176   0.03448 *
A:C        1   81.00   81.00  10.6813   0.01707 *
B:C        1    4.00    4.00   0.5275   0.49502
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
          Df  Sum Sq Mean Sq  F value    Pr(>F)
rep        2 1537.33  768.67 101.3626 2.375e-05 ***
rep:block  9  119.83   13.31   1.7558   0.25388
A          1   36.00   36.00   4.7473   0.07218 .
B          1   36.00   36.00   4.7473   0.07218 .
```

```
A:B         1   12.25   12.25    1.6154    0.25079
C           1   56.25   56.25    7.4176    0.03448 *
A:C         1   81.00   81.00   10.6813    0.01707 *
B:C         1    4.00    4.00    0.5275    0.49502
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
           Df  Sum Sq Mean Sq  F value     Pr(>F)
rep         2 1537.33  768.67 101.3626 2.375e-05 ***
rep:block   9  119.83   13.31   1.7558    0.25388
A           1   36.00   36.00    4.7473    0.07218 .
B           1   36.00   36.00    4.7473    0.07218 .
A:B         1   12.25   12.25    1.6154    0.25079
C           1   56.25   56.25    7.4176    0.03448 *
A:C         1   81.00   81.00   10.6813    0.01707 *
B:C         1    4.00    4.00    0.5275    0.49502
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
               Estimate Std. Error t value  Pr(>|t|)
(Intercept)       41.00     2.7538 14.8886 5.777e-06 ***
rep1             -23.25     3.0788 -7.5516 0.0002798 ***
rep2             -18.25     3.0788 -5.9276 0.0010279 **
rep3               0.00     0.0000
rep1:block1        1.25     3.0788  0.4060 0.6988260
rep1:block10       0.00     0.0000
rep1:block11       0.00     0.0000
rep1:block12       0.00     0.0000
rep1:block2        4.50     3.3727  1.3342 0.2305270
rep1:block3        3.25     3.0788  1.0556 0.3317912
rep1:block4        0.00     0.0000
rep1:block5        0.00     0.0000
rep1:block6        0.00     0.0000
rep1:block7        0.00     0.0000
rep1:block8        0.00     0.0000
rep1:block9        0.00     0.0000
rep2:block1        0.00     0.0000
rep2:block10       0.00     0.0000
rep2:block11       0.00     0.0000
rep2:block12       0.00     0.0000
rep2:block2        0.00     0.0000
rep2:block3        0.00     0.0000
rep2:block4        0.00     0.0000
rep2:block5        9.00     3.0788  2.9232 0.0265209 *
rep2:block6        7.50     3.3727  2.2237 0.0678471 .
rep2:block7        4.50     3.0788  1.4616 0.1941629
```

```
rep2:block8       0.00      0.0000
rep2:block9       0.00      0.0000
rep3:block1       0.00      0.0000
rep3:block10     -5.50      3.0788 -1.7864 0.1242715
rep3:block11      0.00      3.3727  0.0000 1.0000000
rep3:block12     -0.50      3.0788 -0.1624 0.8763224
rep3:block2       0.00      0.0000
rep3:block3       0.00      0.0000
rep3:block4       0.00      0.0000
rep3:block5       0.00      0.0000
rep3:block6       0.00      0.0000
rep3:block7       0.00      0.0000
rep3:block8       0.00      0.0000
rep3:block9       0.00      0.0000
A0               -9.25      2.3848 -3.8787 0.0081834 **
A1                0.00      0.0000
B0               -3.75      2.3848 -1.5724 0.1669121
B1                0.00      0.0000
A0:B0             3.50      2.7538  1.2710 0.2507870
A0:B1             0.00      0.0000
A1:B0             0.00      0.0000
A1:B1             0.00      0.0000
C0               -7.25      2.3848 -3.0400 0.0228021 *
C1                0.00      0.0000
A0:C0             9.00      2.7538  3.2682 0.0170720 *
A0:C1             0.00      0.0000
A1:C0             0.00      0.0000
A1:C1             0.00      0.0000
B0:C0            -2.00      2.7538 -0.7263 0.4950160
B0:C1             0.00      0.0000
B1:C0             0.00      0.0000
B1:C1             0.00      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.6.2 p348

(141) MODEL

```
GLM(y ~ rep + A*B*C + block %in% rep, v2p343) # OK
```

```
$ANOVA
Response : y
            Df Sum Sq Mean Sq F value   Pr(>F)
MODEL       17 1889.8 111.167  14.659 0.001608 **
RESIDUALS    6   45.5   7.583
```

```
CORRECTED TOTAL 23 1935.3
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
          Df  Sum Sq Mean Sq  F value     Pr(>F)
rep        2 1537.33  768.67 101.3626 2.375e-05 ***
A          1   88.17   88.17  11.6264   0.01432 *
B          1   37.50   37.50   4.9451   0.06785 .
A:B        1    2.67    2.67   0.3516   0.57484
C          1   66.67   66.67   8.7912   0.02512 *
A:C        1   37.50   37.50   4.9451   0.06785 .
B:C        1    0.17    0.17   0.0220   0.88700
A:B:C      1   24.00   24.00   3.1648   0.12555
rep:block  8   95.83   11.98   1.5797   0.29730
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
          Df  Sum Sq Mean Sq  F value     Pr(>F)
rep        2 1537.33  768.67 101.3626 2.375e-05 ***
A          1   36.00   36.00   4.7473   0.07218 .
B          1   36.00   36.00   4.7473   0.07218 .
A:B        1   12.25   12.25   1.6154   0.25079
C          1   56.25   56.25   7.4176   0.03448 *
A:C        1   81.00   81.00  10.6813   0.01707 *
B:C        1    4.00    4.00   0.5275   0.49502
A:B:C      0
rep:block  8   95.83   11.98   1.5797   0.29730
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
CAUTION: Singularity Exists !
          Df  Sum Sq Mean Sq  F value     Pr(>F)
rep        2 1537.33  768.67 101.3626 2.375e-05 ***
A          1   36.00   36.00   4.7473   0.07218 .
B          1   36.00   36.00   4.7473   0.07218 .
A:B        1   12.25   12.25   1.6154   0.25079
C          1   56.25   56.25   7.4176   0.03448 *
A:C        1   81.00   81.00  10.6813   0.01707 *
B:C        1    4.00    4.00   0.5275   0.49502
A:B:C      0
rep:block  8   95.83   11.98   1.5797   0.29730
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
```

```
              Estimate Std. Error t value  Pr(>|t|)
(Intercept)     40.50      2.3848 16.9822 2.666e-06 ***
rep1           -22.75      3.0788 -7.3892 0.0003153 ***
rep2           -17.75      3.0788 -5.7652 0.0011880 **
rep3             0.00      0.0000
A0              -8.75      3.8944 -2.2468 0.0657303 .
A1               0.00      0.0000
B0              -3.25      3.3727 -0.9636 0.3724479
B1               0.00      0.0000
A0:B0            2.50      6.7454  0.3706 0.7236497
A0:B1            0.00      0.0000
A1:B0            0.00      0.0000
A1:B1            0.00      0.0000
C0              -6.75      3.3727 -2.0014 0.0922506 .
C1               0.00      0.0000
A0:C0            8.00      6.7454  1.1860 0.2804551
A0:C1            0.00      0.0000
A1:C0            0.00      0.0000
A1:C1            0.00      0.0000
B0:C0           -3.00      5.5076 -0.5447 0.6055942
B0:C1            0.00      0.0000
B1:C0            0.00      0.0000
B1:C1            0.00      0.0000
A0:B0:C0         2.00     12.3153  0.1624 0.8763224
A0:B0:C1         0.00      0.0000
A0:B1:C0         0.00      0.0000
A0:B1:C1         0.00      0.0000
A1:B0:C0         0.00      0.0000
A1:B0:C1         0.00      0.0000
A1:B1:C0         0.00      0.0000
A1:B1:C1         0.00      0.0000
rep1:block1      0.75      4.3541  0.1723 0.8689036
rep1:block10     0.00      0.0000
rep1:block11     0.00      0.0000
rep1:block12     0.00      0.0000
rep1:block2      4.50      3.3727  1.3342 0.2305270
rep1:block3      2.75      4.3541  0.6316 0.5509461
rep1:block4      0.00      0.0000
rep1:block5      0.00      0.0000
rep1:block6      0.00      0.0000
rep1:block7      0.00      0.0000
rep1:block8      0.00      0.0000
rep1:block9      0.00      0.0000
rep2:block1      0.00      0.0000
rep2:block10     0.00      0.0000
rep2:block11     0.00      0.0000
rep2:block12     0.00      0.0000
rep2:block2      0.00      0.0000
```

```
rep2:block3       0.00      0.0000
rep2:block4       0.00      0.0000
rep2:block5       8.50      4.3541   1.9522 0.0987607 .
rep2:block6       7.50      3.3727   2.2237 0.0678471 .
rep2:block7       4.00      4.3541   0.9187 0.3936995
rep2:block8       0.00      0.0000
rep2:block9       0.00      0.0000
rep3:block1       0.00      0.0000
rep3:block10     -5.00      3.3727  -1.4825 0.1887247
rep3:block11      0.00      3.3727   0.0000 1.0000000
rep3:block12      0.00      0.0000
rep3:block2       0.00      0.0000
rep3:block3       0.00      0.0000
rep3:block4       0.00      0.0000
rep3:block5       0.00      0.0000
rep3:block6       0.00      0.0000
rep3:block7       0.00      0.0000
rep3:block8       0.00      0.0000
rep3:block9       0.00      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.6.3   p353

(142) MODEL

```
v2p353 = read.table("C:/G/Rt/Kemp/v2p353.txt", head=TRUE)
v2p353 = af(v2p353, c("rep", "block", "A", "B", "C", "D"))
GLM(y ~ rep + rep:block + A*B*C*D - A:B:C:D, v2p353) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           21 7132.2  339.63  56.022 9.795e-08 ***
RESIDUALS       10   60.6    6.06
CORRECTED TOTAL 31 7192.9
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
          Df Sum Sq Mean Sq  F value     Pr(>F)
rep        1 5940.5  5940.5 979.8763 2.600e-11 ***
rep:block  6  777.4   129.6  21.3711 3.675e-05 ***
A          1  171.1   171.1  28.2268 0.0003412 ***
B          1   18.0    18.0   2.9691 0.1155937
A:B        1    1.6     1.6   0.2577 0.6226914
```

```
C           1  120.1   120.1  19.8144 0.0012326 **
A:C         1    0.6     0.6   0.0928 0.7669127
B:C         1    2.0     2.0   0.3299 0.5784103
A:B:C       1    4.5     4.5   0.7423 0.4091189
D           1    6.1     6.1   1.0103 0.3385304
A:D         1    1.1     1.1   0.1856 0.6757693
B:D         1    5.1     5.1   0.8351 0.3823203
A:B:D       1    0.5     0.5   0.0825 0.7798349
C:D         1    1.6     1.6   0.2577 0.6226914
A:C:D       1   10.1    10.1   1.6701 0.2253083
B:C:D       1   72.0    72.0  11.8763 0.0062660 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
          Df Sum Sq Mean Sq  F value    Pr(>F)
rep        1 5940.5  5940.5 979.8763   2.6e-11 ***
rep:block  6  406.9    67.8  11.1856 0.0006129 ***
A          1  171.1   171.1  28.2268 0.0003412 ***
B          1   18.0    18.0   2.9691 0.1155937
A:B        1    1.6     1.6   0.2577 0.6226914
C          1  120.1   120.1  19.8144 0.0012326 **
A:C        1    0.6     0.6   0.0928 0.7669127
B:C        1    2.0     2.0   0.3299 0.5784103
A:B:C      1    4.5     4.5   0.7423 0.4091189
D          1    6.1     6.1   1.0103 0.3385304
A:D        1    1.1     1.1   0.1856 0.6757693
B:D        1    5.1     5.1   0.8351 0.3823203
A:B:D      1    0.5     0.5   0.0825 0.7798349
C:D        1    1.6     1.6   0.2577 0.6226914
A:C:D      1   10.1    10.1   1.6701 0.2253083
B:C:D      1   72.0    72.0  11.8763 0.0062660 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
          Df Sum Sq Mean Sq  F value    Pr(>F)
rep        1 5940.5  5940.5 979.8763   2.6e-11 ***
rep:block  6  406.9    67.8  11.1856 0.0006129 ***
A          1  171.1   171.1  28.2268 0.0003412 ***
B          1   18.0    18.0   2.9691 0.1155937
A:B        1    1.6     1.6   0.2577 0.6226914
C          1  120.1   120.1  19.8144 0.0012326 **
A:C        1    0.6     0.6   0.0928 0.7669127
B:C        1    2.0     2.0   0.3299 0.5784103
A:B:C      1    4.5     4.5   0.7423 0.4091189
D          1    6.1     6.1   1.0103 0.3385304
A:D        1    1.1     1.1   0.1856 0.6757693
```

```
B:D          1     5.1      5.1     0.8351 0.3823203
A:B:D        1     0.5      0.5     0.0825 0.7798349
C:D          1     1.6      1.6     0.2577 0.6226914
A:C:D        1    10.1     10.1     1.6701 0.2253083
B:C:D        1    72.0     72.0    11.8763 0.0062660 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
             Estimate Std. Error  t value   Pr(>|t|)
(Intercept)    61.438     2.0416  30.0934  3.842e-11 ***
rep1          -32.875     2.1323 -15.4173  2.685e-08 ***
rep2            0.000     0.0000
rep1:block1    -3.125     2.1323  -1.4655  0.1735006
rep1:block2     5.250     2.4622   2.1322  0.0588002 .
rep1:block3     9.125     2.1323   4.2793  0.0016131 **
rep1:block4     0.000     0.0000
rep1:block5     0.000     0.0000
rep1:block6     0.000     0.0000
rep1:block7     0.000     0.0000
rep1:block8     0.000     0.0000
rep2:block1     0.000     0.0000
rep2:block2     0.000     0.0000
rep2:block3     0.000     0.0000
rep2:block4     0.000     0.0000
rep2:block5   -10.625     2.1323  -4.9828  0.0005512 ***
rep2:block6    -4.250     2.4622  -1.7261  0.1150383
rep2:block7     3.625     2.1323   1.7000  0.1199674
rep2:block8     0.000     0.0000
A0             -6.375     2.6116  -2.4411  0.0347860 *
A1              0.000     0.0000
B0             -3.750     2.6116  -1.4359  0.1815604
B1              0.000     0.0000
A0:B0          -0.250     3.4821  -0.0718  0.9441800
A0:B1           0.000     0.0000
A1:B0           0.000     0.0000
A1:B1           0.000     0.0000
C0            -10.250     2.6116  -3.9248  0.0028439 **
C1              0.000     0.0000
A0:C0           4.500     3.4821   1.2923  0.2253083
A0:C1           0.000     0.0000
A1:C0           0.000     0.0000
A1:C1           0.000     0.0000
B0:C0           8.500     3.0156   2.8187  0.0182015 *
B0:C1           0.000     0.0000
B1:C0           0.000     0.0000
B1:C1           0.000     0.0000
A0:B0:C0       -3.000     3.4821  -0.8615  0.4091189
```

```
A0:B0:C1      0.000      0.0000
A0:B1:C0      0.000      0.0000
A0:B1:C1      0.000      0.0000
A1:B0:C0      0.000      0.0000
A1:B0:C1      0.000      0.0000
A1:B1:C0      0.000      0.0000
A1:B1:C1      0.000      0.0000
D0           -4.625      2.6116  -1.7710 0.1069851
D1            0.000      0.0000
A0:D0         2.500      3.0156   0.8290 0.4264346
A0:D1         0.000      0.0000
A1:D0         0.000      0.0000
A1:D1         0.000      0.0000
B0:D0         3.250      3.4821   0.9333 0.3726292
B0:D1         0.000      0.0000
B1:D0         0.000      0.0000
B1:D1         0.000      0.0000
A0:B0:D0      1.000      3.4821   0.2872 0.7798349
A0:B0:D1      0.000      0.0000
A0:B1:D0      0.000      0.0000
A0:B1:D1      0.000      0.0000
A1:B0:D0      0.000      0.0000
A1:B0:D1      0.000      0.0000
A1:B1:D0      0.000      0.0000
A1:B1:D1      0.000      0.0000
C0:D0         9.500      3.4821   2.7282 0.0212575 *
C0:D1         0.000      0.0000
C1:D0         0.000      0.0000
C1:D1         0.000      0.0000
A0:C0:D0     -4.500      3.4821  -1.2923 0.2253083
A0:C0:D1      0.000      0.0000
A0:C1:D0      0.000      0.0000
A0:C1:D1      0.000      0.0000
A1:C0:D0      0.000      0.0000
A1:C0:D1      0.000      0.0000
A1:C1:D0      0.000      0.0000
A1:C1:D1      0.000      0.0000
B0:C0:D0    -12.000      3.4821  -3.4462 0.0062660 **
B0:C0:D1      0.000      0.0000
B0:C1:D0      0.000      0.0000
B0:C1:D1      0.000      0.0000
B1:C0:D0      0.000      0.0000
B1:C0:D1      0.000      0.0000
B1:C1:D0      0.000      0.0000
B1:C1:D1      0.000      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.7 Chapter 10

9.7.1 p388

(143) MODEL

```
v2p388 = read.table("C:/G/Rt/Kemp/v2p388.txt", head=TRUE)
v2p388 = af(v2p388, c("rep", "block", "A", "B"))
GLM(y ~ rep + A*B + rep:block, v2p388) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           11 1136.8 103.343  124.01 3.698e-06 ***
RESIDUALS        6    5.0   0.833
CORRECTED TOTAL 17 1141.8
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
          Df Sum Sq Mean Sq  F value     Pr(>F)
rep        1 410.89  410.89 493.0667 5.455e-07 ***
A          2 228.11  114.06 136.8667 9.868e-06 ***
B          2   3.44    1.72   2.0667  0.207585
A:B        4 464.22  116.06 139.2667 4.801e-06 ***
rep:block  2  30.11   15.06  18.0667  0.002888 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
          Df Sum Sq Mean Sq  F value     Pr(>F)
rep        1 410.89  410.89 493.0667 5.455e-07 ***
A          2 228.11  114.06 136.8667 9.868e-06 ***
B          2   3.44    1.72   2.0667  0.207585
A:B        2  18.78    9.39  11.2667  0.009298 **
rep:block  2  30.11   15.06  18.0667  0.002888 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
CAUTION: Singularity Exists !
          Df Sum Sq Mean Sq  F value     Pr(>F)
rep        1 410.89  410.89 493.0667 5.455e-07 ***
A          2 228.11  114.06 136.8667 9.868e-06 ***
B          2   3.44    1.72   2.0667  0.207585
A:B        2  18.78    9.39  11.2667  0.009298 **
rep:block  2  30.11   15.06  18.0667  0.002888 **
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error  t value  Pr(>|t|)
(Intercept)   42.833    0.74536  57.4669 1.865e-09 ***
rep1         -12.667    0.74536 -16.9941 2.655e-06 ***
rep2           0.000    0.00000
A0           -16.167    1.05409 -15.3370 4.854e-06 ***
A1           -18.500    1.05409 -17.5506 2.196e-06 ***
A2             0.000    0.00000
B0           -10.167    1.05409  -9.6449 7.115e-05 ***
B1           -13.500    1.05409 -12.8072 1.392e-05 ***
B2             0.000    0.00000
A0:B0          3.833    1.58114   2.4244 0.0515527 .
A0:B1         18.667    1.58114  11.8058 2.232e-05 ***
A0:B2          0.000    0.00000
A1:B0         26.167    1.58114  16.5493 3.104e-06 ***
A1:B1         18.833    1.58114  11.9112 2.120e-05 ***
A1:B2          0.000    0.00000
A2:B0          0.000    0.00000
A2:B1          0.000    0.00000
A2:B2          0.000    0.00000
rep1:block1    3.000    1.05409   2.8460 0.0293332 *
rep1:block2    6.333    1.05409   6.0083 0.0009575 ***
rep1:block3    0.000    0.00000
rep1:block4    0.000    0.00000
rep1:block5    0.000    0.00000
rep1:block6    0.000    0.00000
rep2:block1    0.000    0.00000
rep2:block2    0.000    0.00000
rep2:block3    0.000    0.00000
rep2:block4    0.000    0.00000
rep2:block5    0.000    0.00000
rep2:block6    0.000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.8   Chapter 14

9.8.1   p570

(144) MODEL

```r
v2p570 = read.table("C:/G/Rt/Kemp/v2p570.txt", head=TRUE)
v2p570 = af(v2p570, c("A", "B", "C", "D"))
GLM(Y ~ A + B + C + D + A:B + A:C + A:D + B:C + B:D + C:D, v2p570) # OK
```

```
$ANOVA
Response : Y
               Df Sum Sq Mean Sq F value Pr(>F)
MODEL            8 22.222  2.7778
RESIDUALS        0  0.000
CORRECTED TOTAL  8 22.222

$`Type I`
    Df  Sum Sq Mean Sq F value Pr(>F)
A    2  2.8889  1.4444
B    2  2.8889  1.4444
C    2  1.5556  0.7778
D    2 14.8889  7.4444
A:B  0
A:C  0
A:D  0
B:C  0
B:D  0
C:D  0

$`Type II`
    Df Sum Sq Mean Sq F value Pr(>F)
A    0
B    0
C    0
D    0
A:B  0
A:C  0
A:D  0
B:C  0
B:D  0
C:D  0

$`Type III`
CAUTION: Singularity Exists !
    Df Sum Sq Mean Sq F value Pr(>F)
A    0
B    0
C    0
D    0
A:B  0
A:C  0
A:D  0
B:C  0
B:D  0
C:D  0

$Parameter
```

```
              Estimate Std. Error t value Pr(>|t|)
(Intercept)    9.3333
A0            -1.3333
A1            -1.0000
A2             0.0000
B0            -0.3333
B1             1.0000
B2             0.0000
C0            -0.3333
C1            -1.0000
C2             0.0000
D0            -2.3333
D1            -3.0000
D2             0.0000
A0:B0          0.0000
A0:B1          0.0000
A0:B2          0.0000
A1:B0          0.0000
A1:B1          0.0000
A1:B2          0.0000
A2:B0          0.0000
A2:B1          0.0000
A2:B2          0.0000
A0:C0          0.0000
A0:C1          0.0000
A0:C2          0.0000
A1:C0          0.0000
A1:C1          0.0000
A1:C2          0.0000
A2:C0          0.0000
A2:C1          0.0000
A2:C2          0.0000
A0:D0          0.0000
A0:D1          0.0000
A0:D2          0.0000
A1:D0          0.0000
A1:D1          0.0000
A1:D2          0.0000
A2:D0          0.0000
A2:D1          0.0000
A2:D2          0.0000
B0:C0          0.0000
B0:C1          0.0000
B0:C2          0.0000
B1:C0          0.0000
B1:C1          0.0000
B1:C2          0.0000
B2:C0          0.0000
```

```
B2:C1          0.0000
B2:C2          0.0000
B0:D0          0.0000
B0:D1          0.0000
B0:D2          0.0000
B1:D0          0.0000
B1:D1          0.0000
B1:D2          0.0000
B2:D0          0.0000
B2:D1          0.0000
B2:D2          0.0000
C0:D0          0.0000
C0:D1          0.0000
C0:D2          0.0000
C1:D0          0.0000
C1:D1          0.0000
C1:D2          0.0000
C2:D0          0.0000
C2:D1          0.0000
C2:D2          0.0000
```

9.8.2   p578

(145) MODEL

```
v2p578 = read.table("C:/G/Rt/Kemp/v2p578.txt", head=TRUE)
v2p578 = af(v2p578, 1:11)
GLM(Y ~ A + B + C + D + E + F + G + H + J + K + L, v2p578) # OK
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL           11    575  52.273
RESIDUALS        0      0
CORRECTED TOTAL 11    575

$`Type I`
  Df  Sum Sq Mean Sq F value Pr(>F)
A  1   3.000   3.000
B  1  27.000  27.000
C  1  12.000  12.000
D  1  16.333  16.333
E  1 176.333 176.333
F  1 133.333 133.333
G  1   1.333   1.333
H  1  21.333  21.333
```

```
J  1 108.000 108.000
K  1   1.333   1.333
L  1  75.000  75.000


$`Type II`
  Df  Sum Sq Mean Sq F value Pr(>F)
A  1   3.000   3.000
B  1  27.000  27.000
C  1  12.000  12.000
D  1  16.333  16.333
E  1 176.333 176.333
F  1 133.333 133.333
G  1   1.333   1.333
H  1  21.333  21.333
J  1 108.000 108.000
K  1   1.333   1.333
L  1  75.000  75.000


$`Type III`
  Df  Sum Sq Mean Sq F value Pr(>F)
A  1   3.000   3.000
B  1  27.000  27.000
C  1  12.000  12.000
D  1  16.333  16.333
E  1 176.333 176.333
F  1 133.333 133.333
G  1   1.333   1.333
H  1  21.333  21.333
J  1 108.000 108.000
K  1   1.333   1.333
L  1  75.000  75.000


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  21.0000
A0            1.0000
A1            0.0000
B0            3.0000
B1            0.0000
C0            2.0000
C1            0.0000
D0            2.3333
D1            0.0000
E0            7.6667
E1            0.0000
F0            6.6667
F1            0.0000
G0            0.6667
```

```
G1              0.0000
H0             -2.6667
H1              0.0000
J0             -6.0000
J1              0.0000
K0             -0.6667
K1              0.0000
L0             -5.0000
L1              0.0000
```

(146) MODEL

```
GLM(Y ~ E*F + E*J + F*J + E*L + F*L + J*L, v2p578) # OK
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value  Pr(>F)
MODEL           10  574.5   57.45   114.9 0.07249 .
RESIDUALS        1    0.5    0.50
CORRECTED TOTAL 11  575.0
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
    Df  Sum Sq Mean Sq  F value  Pr(>F)
E    1 176.333 176.333 352.6667 0.03387 *
F    1 133.333 133.333 266.6667 0.03894 *
E:F  1  65.333  65.333 130.6667 0.05555 .
J    1  66.667  66.667 133.3333 0.05500 .
E:J  1   2.667   2.667   5.3333 0.26015
F:J  1 112.667 112.667 225.3333 0.04235 *
L    1  10.800  10.800  21.6000 0.13492
E:L  1   5.486   5.486  10.9714 0.18666
F:L  1   0.176   0.176   0.3516 0.65925
J:L  1   1.038   1.038   2.0769 0.38618
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
    Df Sum Sq Mean Sq  F value  Pr(>F)
E    1 61.633  61.633 123.2667 0.05719 .
F    1 75.208  75.208 150.4167 0.05179 .
E:F  1  9.346   9.346  18.6923 0.14470
J    1 54.675  54.675 109.3500 0.06069 .
E:J  1  0.115   0.115   0.2308 0.71490
F:J  1 72.115  72.115 144.2308 0.05289 .
L    1 10.800  10.800  21.6000 0.13492
```

```
E:L  1  5.654    5.654   11.3077 0.18402
F:L  1  0.115    0.115    0.2308 0.71490
J:L  1  1.038    1.038    2.0769 0.38618
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
    Df Sum Sq Mean Sq  F value  Pr(>F)
E    1 61.038  61.038 122.0769 0.05746 .
F    1 61.038  61.038 122.0769 0.05746 .
E:F  1  9.346   9.346  18.6923 0.14470
J    1 61.038  61.038 122.0769 0.05746 .
E:J  1  0.115   0.115   0.2308 0.71490
F:J  1 72.115  72.115 144.2308 0.05289 .
L    1  9.346   9.346  18.6923 0.14470
E:L  1  5.654   5.654  11.3077 0.18402
F:L  1  0.115   0.115   0.2308 0.71490
J:L  1  1.038   1.038   2.0769 0.38618
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error  t value Pr(>|t|)
(Intercept)    26.5     1.1180  23.7023  0.02684 *
E0              6.0     1.1547   5.1962  0.12104
E1              0.0     0.0000
F0              1.5     1.0408   1.4412  0.38618
F1              0.0     0.0000
E0:F0          -4.5     1.0408  -4.3235  0.14470
E0:F1           0.0     0.0000
E1:F0           0.0     0.0000
E1:F1           0.0     0.0000
J0            -11.5     1.0408 -11.0488  0.05746 .
J1              0.0     0.0000
E0:J0           0.5     1.0408   0.4804  0.71490
E0:J1           0.0     0.0000
E1:J0           0.0     0.0000
E1:J1           0.0     0.0000
F0:J0          12.5     1.0408  12.0096  0.05289 .
F0:J1           0.0     0.0000
F1:J0           0.0     0.0000
F1:J1           0.0     0.0000
L0             -3.5     1.0408  -3.3627  0.18402
L1              0.0     0.0000
E0:L0           3.5     1.0408   3.3627  0.18402
E0:L1           0.0     0.0000
E1:L0           0.0     0.0000
E1:L1           0.0     0.0000
```

```
F0:L0            0.5     1.0408    0.4804  0.71490
F0:L1            0.0     0.0000
F1:L0            0.0     0.0000
F1:L1            0.0     0.0000
J0:L0           -1.5     1.0408   -1.4412  0.38618
J0:L1            0.0     0.0000
J1:L0            0.0     0.0000
J1:L1            0.0     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.9   Chapter 16

9.9.1   p619

(147) MODEL

```
v2p619 = read.table("C:/G/Rt/Kemp/v2p619.txt", head=TRUE)
v2p619 = af(v2p619, c("A", "B", "C"))
GLM(y ~ A + B + C + A:B, v2p619) # OK
```

```
Warning in sqrt(diag(bVar)): NaNs produced


$ANOVA
Response : y
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL            4 31.429  7.8571
RESIDUALS        2  0.000  0.0000
CORRECTED TOTAL  6 31.429


$`Type I`
    Df  Sum Sq Mean Sq      F value Pr(>F)
A    1 13.7619 13.7619 -2.7424e+14      1
B    1  1.6667  1.6667 -3.3212e+13      1
C    1 10.0000 10.0000 -1.9927e+14      1
A:B  1  6.0000  6.0000 -1.1956e+14      1


$`Type II`
    Df Sum Sq Mean Sq      F value Pr(>F)
A    1   19.6    19.6 -3.9058e+14      1
B    1    3.6     3.6 -7.1739e+13      1
C    1   13.5    13.5 -2.6902e+14      1
A:B  1    6.0     6.0 -1.1956e+14      1


$`Type III`
    Df Sum Sq Mean Sq      F value Pr(>F)
```

```
A   1   24.0     24.0 -4.7826e+14      1
B   1    6.0      6.0 -1.1956e+14      1
C   1   13.5     13.5 -2.6902e+14      1
A:B 1    6.0      6.0 -1.1956e+14      1
```

```
$Parameter
             Estimate Std. Error t value Pr(>|t|)
(Intercept)      13.5
A0               -6.0
A1                0.0            0
B0                0.0
B1                0.0            0
C0               -3.0
C1                0.0            0
A0:B0             4.0
A0:B1             0.0            0
A1:B0             0.0            0
A1:B1             0.0            0
```

(148) MODEL

```
GLM(y ~ A + B + C + A:C, v2p619) # OK
```

```
$ANOVA
Response : y
                 Df  Sum Sq Mean Sq F value Pr(>F)
MODEL             4 26.0952  6.5238  2.4464 0.3106
RESIDUALS         2  5.3333  2.6667
CORRECTED TOTAL   6 31.4286
```

```
$`Type I`
    Df  Sum Sq Mean Sq F value Pr(>F)
A    1 13.7619 13.7619  5.1607 0.1511
B    1  1.6667  1.6667  0.6250 0.5120
C    1 10.0000 10.0000  3.7500 0.1924
A:C  1  0.6667  0.6667  0.2500 0.6667
```

```
$`Type II`
    Df  Sum Sq Mean Sq F value Pr(>F)
A    1 19.6000 19.6000    7.35 0.1134
B    1  2.6667  2.6667    1.00 0.4226
C    1 10.0000 10.0000    3.75 0.1924
A:C  1  0.6667  0.6667    0.25 0.6667
```

```
$`Type III`
    Df  Sum Sq Mean Sq F value Pr(>F)
A    1 16.6667 16.6667  6.2500 0.1296
```

```
B    1  2.6667  2.6667  1.0000 0.4226
C    1  8.1667  8.1667  3.0625 0.2222
A:C  1  0.6667  0.6667  0.2500 0.6667


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  12.8333     1.3333  9.6250  0.01062 *
A0           -4.0000     1.6330 -2.4495  0.13397
A1            0.0000     0.0000
B0            1.3333     1.3333  1.0000  0.42265
B1            0.0000     0.0000
C0           -3.0000     1.6330 -1.8371  0.20759
C1            0.0000     0.0000
A0:C0         1.3333     2.6667  0.5000  0.66667
A0:C1         0.0000     0.0000
A1:C0         0.0000     0.0000
A1:C1         0.0000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(149) MODEL

```
GLM(y ~ A + B + C + B:C, v2p619) # OK
```

```
$ANOVA
Response : y
                 Df  Sum Sq Mean Sq F value Pr(>F)
MODEL             4 26.0952  6.5238  2.4464 0.3106
RESIDUALS         2  5.3333  2.6667
CORRECTED TOTAL   6 31.4286


$`Type I`
    Df  Sum Sq Mean Sq F value Pr(>F)
A    1 13.7619 13.7619  5.1607 0.1511
B    1  1.6667  1.6667  0.6250 0.5120
C    1 10.0000 10.0000  3.7500 0.1924
B:C  1  0.6667  0.6667  0.2500 0.6667


$`Type II`
    Df  Sum Sq Mean Sq F value Pr(>F)
A    1 16.6667 16.6667    6.25 0.1296
B    1  3.6000  3.6000    1.35 0.3652
C    1 10.0000 10.0000    3.75 0.1924
B:C  1  0.6667  0.6667    0.25 0.6667


$`Type III`
    Df  Sum Sq Mean Sq F value Pr(>F)
```

```
A     1 16.6667 16.6667  6.2500 0.1296
B     1  2.6667  2.6667  1.0000 0.4226
C     1  8.1667  8.1667  3.0625 0.2222
B:C   1  0.6667  0.6667  0.2500 0.6667


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  12.1667     1.3333  9.1250   0.0118 *
A0           -3.3333     1.3333 -2.5000   0.1296
A1            0.0000     0.0000
B0            2.0000     1.6330  1.2247   0.3453
B1            0.0000     0.0000
C0           -1.6667     2.1082 -0.7906   0.5120
C1            0.0000     0.0000
B0:C0        -1.3333     2.6667 -0.5000   0.6667
B0:C1         0.0000     0.0000
B1:C0         0.0000     0.0000
B1:C1         0.0000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.9.2 p626

(150) MODEL

```r
v2p626 = read.table("C:/G/Rt/Kemp/v2p626.txt", head=TRUE)
v2p626 = af(v2p626, c("A", "B", "C"))
GLM(y ~ A + B + C + A:B, v2p626) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value  Pr(>F)
MODEL            4 42.092 10.5231  22.002 0.04395 *
RESIDUALS        2  0.957  0.4783
CORRECTED TOTAL  6 43.049
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
    Df  Sum Sq Mean Sq F value  Pr(>F)
A    1 16.2088 16.2088  33.890 0.02826 *
B    1  4.8150  4.8150  10.068 0.08662 .
C    1 15.7339 15.7339  32.898 0.02908 *
A:B  1  5.3346  5.3346  11.154 0.07916 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
    Df  Sum Sq Mean Sq F value  Pr(>F)
A    1 25.4131 25.4131  53.136 0.01830 *
B    1  8.6630  8.6630  18.113 0.05102 .
C    1 19.5193 19.5193  40.812 0.02364 *
A:B  1  5.3346  5.3346  11.154 0.07916 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
    Df  Sum Sq Mean Sq F value  Pr(>F)
A    1 29.7950 29.7950  62.297 0.01568 *
B    1 11.7460 11.7460  24.559 0.03839 *
C    1 19.5193 19.5193  40.812 0.02364 *
A:B  1  5.3346  5.3346  11.154 0.07916 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  13.7877    0.56467 24.4174 0.001673 **
A0           -6.3427    0.89281 -7.1041 0.019244 *
A1            0.0000    0.00000
B0            0.9125    0.69157  1.3195 0.317812
B1            0.0000    0.00000
C0           -3.6073    0.56467 -6.3884 0.023637 *
C1            0.0000    0.00000
A0:B0         3.7717    1.12933  3.3397 0.079156 .
A0:B1         0.0000    0.00000
A1:B0         0.0000    0.00000
A1:B1         0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(151) MODEL
```

```r
GLM(y ~ A + B + C + A:C, v2p626) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL            4 39.229  9.8072  5.1346 0.1696
RESIDUALS        2  3.820  1.9100
CORRECTED TOTAL  6 43.049

$`Type I`
```

```
    Df  Sum Sq Mean Sq F value Pr(>F)
A    1 16.2088 16.2088  8.4862 0.1004
B    1  4.8150  4.8150  2.5209 0.2533
C    1 15.7339 15.7339  8.2376 0.1030
A:C  1  2.4711  2.4711  1.2937 0.3733


$`Type II`
    Df  Sum Sq Mean Sq F value  Pr(>F)
A    1 25.4131 25.4131 13.3052 0.06762 .
B    1  6.0361  6.0361  3.1602 0.21743
C    1 15.7339 15.7339  8.2376 0.10298
A:C  1  2.4711  2.4711  1.2937 0.37327
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
    Df  Sum Sq Mean Sq F value  Pr(>F)
A    1 20.1428 20.1428 10.5459 0.08317 .
B    1  6.0361  6.0361  3.1602 0.21743
C    1 11.8863 11.8863  6.2232 0.13007
A:C  1  2.4711  2.4711  1.2937 0.37327
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  13.4865     1.1284 11.9516 0.006928 **
A0           -4.9480     1.3820 -3.5802 0.069930 .
A1            0.0000     0.0000
B0            2.0060     1.1284  1.7777 0.217428
B1            0.0000     0.0000
C0           -4.0985     1.3820 -2.9656 0.097381 .
C1            0.0000     0.0000
A0:C0         2.5670     2.2569  1.1374 0.373273
A0:C1         0.0000     0.0000
A1:C0         0.0000     0.0000
A1:C1         0.0000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(152) MODEL

```
GLM(y ~ A + B + C + B:C, v2p626) # OK


$ANOVA
Response : y
                Df Sum Sq Mean Sq F value Pr(>F)
```

```
MODEL            4 37.340  9.3349  3.2701 0.2477
RESIDUALS        2  5.709  2.8546
CORRECTED TOTAL  6 43.049


$`Type I`
    Df  Sum Sq Mean Sq F value Pr(>F)
A    1 16.2088 16.2088  5.6781 0.1400
B    1  4.8150  4.8150  1.6867 0.3236
C    1 15.7339 15.7339  5.5118 0.1434
B:C  1  0.5819  0.5819  0.2038 0.6959


$`Type II`
    Df  Sum Sq Mean Sq F value Pr(>F)
A    1 21.9995 21.9995  7.7067 0.1090
B    1  8.6630  8.6630  3.0347 0.2236
C    1 15.7339 15.7339  5.5118 0.1434
B:C  1  0.5819  0.5819  0.2038 0.6959


$`Type III`
    Df  Sum Sq Mean Sq F value Pr(>F)
A    1 21.9995 21.9995  7.7067 0.1090
B    1  7.0709  7.0709  2.4770 0.2562
C    1 13.3221 13.3221  4.6669 0.1633
B:C  1  0.5819  0.5819  0.2038 0.6959


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  12.5333     1.3795  9.0853   0.0119 *
A0           -3.8297     1.3795 -2.7761   0.1090
A1            0.0000     0.0000
B0            2.7940     1.6896  1.6537   0.2400
B1            0.0000     0.0000
C0           -2.3573     2.1812 -1.0807   0.3928
C1            0.0000     0.0000
B0:C0        -1.2457     2.7590 -0.4515   0.6959
B0:C1         0.0000     0.0000
B1:C0         0.0000     0.0000
B1:C1         0.0000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.10   Chapter 17

9.10.1   p642

(153) MODEL

```
v2p642 = read.table("C:/G/Rt/Kemp/v2p642.txt", head=TRUE)
v2p642 = af(v2p642, 2:11)
GLM(Y ~ A + B + C + D + E + F + G, v2p642) # OK
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL            7   11.0 1.57143  1.6688 0.1646
RESIDUALS       24   22.6 0.94167
CORRECTED TOTAL 31   33.6


$`Type I`
  Df Sum Sq Mean Sq F value  Pr(>F)
A  1 5.7800  5.7800  6.1381 0.02066 *
B  1 0.1800  0.1800  0.1912 0.66587
C  1 0.1250  0.1250  0.1327 0.71879
D  1 2.5312  2.5312  2.6881 0.11415
E  1 0.6613  0.6613  0.7022 0.41031
F  1 0.0112  0.0112  0.0119 0.91387
G  1 1.7113  1.7113  1.8173 0.19023
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
  Df Sum Sq Mean Sq F value  Pr(>F)
A  1 5.7800  5.7800  6.1381 0.02066 *
B  1 0.1800  0.1800  0.1912 0.66587
C  1 0.1250  0.1250  0.1327 0.71879
D  1 2.5312  2.5312  2.6881 0.11415
E  1 0.6613  0.6613  0.7022 0.41031
F  1 0.0112  0.0112  0.0119 0.91387
G  1 1.7113  1.7113  1.8173 0.19023
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
  Df Sum Sq Mean Sq F value  Pr(>F)
A  1 5.7800  5.7800  6.1381 0.02066 *
B  1 0.1800  0.1800  0.1912 0.66587
C  1 0.1250  0.1250  0.1327 0.71879
D  1 2.5312  2.5312  2.6881 0.11415
E  1 0.6613  0.6613  0.7022 0.41031
F  1 0.0112  0.0112  0.0119 0.91387
G  1 1.7113  1.7113  1.8173 0.19023
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   2.2750    0.48520  4.6888 9.162e-05 ***
A0           -0.8500    0.34309 -2.4775   0.02066 *
A1            0.0000    0.00000
B0            0.1500    0.34309  0.4372   0.66587
B1            0.0000    0.00000
C0           -0.1250    0.34309 -0.3643   0.71879
C1            0.0000    0.00000
D0            0.5625    0.34309  1.6395   0.11415
D1            0.0000    0.00000
E0           -0.2875    0.34309 -0.8380   0.41031
E1            0.0000    0.00000
F0            0.0375    0.34309  0.1093   0.91387
F1            0.0000    0.00000
G0            0.4625    0.34309  1.3481   0.19023
G1            0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(154) MODEL

```
GLM(log(S) ~ A + B + C + D + E + F + G, v2p642) # OK
```

Warning in sqrt(diag(bVar)): NaNs produced

```
$ANOVA
Response : log(S)
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL            7 266.43  38.062
RESIDUALS       24   0.00   0.000
CORRECTED TOTAL 31 266.43
```

```
$`Type I`
  Df  Sum Sq Mean Sq      F value Pr(>F)
A  1   1.511   1.511 -3.3064e+14      1
B  1   0.600   0.600 -1.3137e+14      1
C  1   0.284   0.284 -6.2177e+13      1
D  1   0.384   0.384 -8.3917e+13      1
E  1   0.741   0.741 -1.6223e+14      1
F  1 261.783 261.783 -5.7278e+16      1
G  1   1.127   1.127 -2.4665e+14      1
```

```
$`Type II`
  Df  Sum Sq Mean Sq      F value Pr(>F)
A  1   1.511   1.511 -3.3064e+14      1
B  1   0.600   0.600 -1.3137e+14      1
```

```
C  1    0.284    0.284 -6.2177e+13     1
D  1    0.384    0.384 -8.3917e+13     1
E  1    0.741    0.741 -1.6223e+14     1
F  1 261.783 261.783 -5.7278e+16     1
G  1    1.127    1.127 -2.4665e+14     1


$`Type III`
  Df  Sum Sq Mean Sq     F value Pr(>F)
A  1    1.511    1.511 -3.3064e+14     1
B  1    0.600    0.600 -1.3137e+14     1
C  1    0.284    0.284 -6.2177e+13     1
D  1    0.384    0.384 -8.3917e+13     1
E  1    0.741    0.741 -1.6223e+14     1
F  1 261.783 261.783 -5.7278e+16     1
G  1    1.127    1.127 -2.4665e+14     1


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)    0.2218
A0             0.4346
A1             0.0000          0
B0            -0.2740
B1             0.0000          0
C0             0.1885
C1             0.0000          0
D0            -0.2190
D1             0.0000          0
E0             0.3044
E1             0.0000          0
F0            -5.7204
F1             0.0000          0
G0             0.3754
G1             0.0000          0
```

9.11   Chapter 19

9.11.1   p700

(155) MODEL

```
v2p700 = read.table("C:/G/Rt/Kemp/v2p700.txt", head=TRUE)
v2p700 = af(v2p700, 2:5)
GLM(Y ~ P + S + T + C, v2p700) # OK
```

```
$ANOVA
Response : Y
```

```
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           12 378.80 31.5670  57.256 0.003319 **
RESIDUALS        3   1.65  0.5513
CORRECTED TOTAL 15 380.46
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
  Df  Sum Sq Mean Sq F value   Pr(>F)
P  3  53.888  17.963  32.580 0.008646 **
S  3 154.508  51.503  93.414 0.001845 **
T  3 149.848  49.949  90.597 0.001930 **
C  3  20.561   6.854  12.431 0.033708 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
  Df  Sum Sq Mean Sq F value   Pr(>F)
P  2   2.220   1.110  2.0133 0.278974
S  3 111.966  37.322 67.6941 0.002969 **
T  3 161.828  53.943 97.8403 0.001722 **
C  3  20.561   6.854 12.4311 0.033708 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
CAUTION: Singularity Exists !
  Df  Sum Sq Mean Sq F value   Pr(>F)
P  2   2.220   1.110  2.0133 0.278974
S  3 111.966  37.322 67.6941 0.002969 **
T  3 161.828  53.943 97.8403 0.001722 **
C  3  20.561   6.854 12.4311 0.033708 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   14.675    0.76085 19.2875 0.0003044 ***
P1             4.670    0.66413  7.0318 0.0059092 **
P2            -0.600    0.52504 -1.1428 0.3360714
P3             0.450    0.52504  0.8571 0.4544117
P4             0.000    0.00000
S1             2.860    0.55067  5.1937 0.0138648 *
S2             3.595    0.55067  6.5285 0.0073033 **
S3            -3.455    0.55067 -6.2742 0.0081740 **
S4             0.000    0.00000
T1             5.650    0.55067 10.2603 0.0019739 **
T2             6.255    0.55067 11.3590 0.0014638 **
```

```
T3              -1.285    0.55067 -2.3335 0.1018191
T4               0.000    0.00000
C0               0.000    0.00000
C1               2.800    0.66413  4.2161 0.0243844 *
C2               0.620    0.66413  0.9336 0.4193997
C3              -1.140    0.66413 -1.7165 0.1845672
C4               0.000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.11.2 p703

(156) MODEL

```
v2p703 = read.table("C:/G/Rt/Kemp/v2p703.txt", head=TRUE)
v2p703$C = ifelse(v2p703$C == 0, 4, v2p703$C)
v2p703 = af(v2p703, 2:5)
GLM(Y ~ P + S + T + C, v2p703) # OK
```

```
$ANOVA
Response : Y
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           13 385.18 29.6293  21.766 0.0005673 ***
RESIDUALS        6   8.17  1.3613
CORRECTED TOTAL 19 393.35
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
  Df  Sum Sq Mean Sq F value    Pr(>F)
P  4  56.408  14.102 10.3596 0.0073255 **
S  3 119.260  39.753 29.2036 0.0005620 ***
T  3 190.430  63.477 46.6312 0.0001498 ***
C  3  19.083   6.361  4.6728 0.0518237 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
  Df  Sum Sq Mean Sq F value    Pr(>F)
P  4  52.288  13.072  9.6028 0.0088641 **
S  3 167.414  55.805 40.9952 0.0002163 ***
T  3 190.430  63.477 46.6312 0.0001498 ***
C  3  19.083   6.361  4.6728 0.0518237 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
  Df  Sum Sq Mean Sq F value    Pr(>F)
P  4  52.287  13.072  9.6028 0.0088641 **
S  3 167.414  55.805 40.9952 0.0002163 ***
T  3 190.430  63.477 46.6312 0.0001498 ***
C  3  19.083   6.361  4.6728 0.0518237 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)  14.2042    1.02435 13.8665 8.759e-06 ***
P1            4.8875    0.96740  5.0522 0.0023285 **
P2           -0.7000    0.82500 -0.8485 0.4287138
P3            0.3500    0.82500  0.4242 0.6861791
P4           -0.1000    0.82500 -0.1212 0.9074805
P5            0.0000    0.00000
S1            3.4500    0.75312  4.5810 0.0037667 **
S2            3.4250    0.75312  4.5478 0.0039011 **
S3           -3.7083    0.75312 -4.9240 0.0026462 **
S4            0.0000    0.00000
T1            5.5667    0.75312  7.3915 0.0003148 ***
T2            6.4250    0.75312  8.5312 0.0001422 ***
T3           -0.5250    0.75312 -0.6971 0.5118309
T4            0.0000    0.00000
C1            2.6750    0.82500  3.2424 0.0176331 *
C2            0.8750    0.82500  1.0606 0.3296846
C3            0.0000    0.82500  0.0000 1.0000000
C4            0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10   Lawson - DAE with SAS

Reference

- Lawson J. Design and Analysis of Experiments with SAS. Taylor and Francis Group. 2010.

Loading required package: daewr

Registered S3 method overwritten by 'DoE.base':
  method   from
  factorize.factor conf.design

```
require(daewr)
```

10.1   Chapter 2

10.1.1   p22

(157) MODEL

```
GLM(height ~ time, bread) # OK
```

```
$ANOVA
Response : height
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL            2 21.573 10.7865  4.6022  0.042 *
RESIDUALS        9 21.094  2.3438
CORRECTED TOTAL 11 42.667
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
     Df Sum Sq Mean Sq F value Pr(>F)
time  2 21.573  10.787  4.6022  0.042 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
     Df Sum Sq Mean Sq F value Pr(>F)
time  2 21.573  10.787  4.6022  0.042 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
     Df Sum Sq Mean Sq F value Pr(>F)
```

```
time  2 21.573  10.787  4.6022  0.042 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   8.3125    0.76547 10.8594 1.794e-06 ***
time35       -2.8750    1.08253 -2.6558   0.02623 *
time40       -0.0625    1.08253 -0.0577   0.95522
time45        0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.1.2 p32

(158) MODEL

```
GLM(height^(1 - 1.294869) ~ time, bread) # OK
```

```
$ANOVA
Response : height^(1 - 1.294869)
                Df    Sum Sq   Mean Sq F value  Pr(>F)
MODEL            2 0.0130560 0.0065280  5.9356 0.02271 *
RESIDUALS        9 0.0098983 0.0010998
CORRECTED TOTAL 11 0.0229544
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
     Df   Sum Sq  Mean Sq F value  Pr(>F)
time  2 0.013056 0.006528  5.9356 0.02271 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
     Df   Sum Sq  Mean Sq F value  Pr(>F)
time  2 0.013056 0.006528  5.9356 0.02271 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
     Df   Sum Sq  Mean Sq F value  Pr(>F)
time  2 0.013056 0.006528  5.9356 0.02271 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)  0.53776    0.016582 32.4307 1.239e-10 ***
time35       0.07182    0.023450  3.0626   0.01351 *
time40       0.00385    0.023450  0.1643   0.87315
time45       0.00000    0.000000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.1.3 p42

(159) MODEL

```
GLM(yield ~ treat, sugarbeet) # OK
```

```
$ANOVA
Response : yield
                Df Sum Sq Mean Sq F value     Pr(>F)
MODEL            3 291.00  97.002    45.9 1.718e-07 ***
RESIDUALS       14  29.59   2.113
CORRECTED TOTAL 17 320.59
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
      Df Sum Sq Mean Sq F value     Pr(>F)
treat  3    291  97.002    45.9 1.718e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
      Df Sum Sq Mean Sq F value     Pr(>F)
treat  3    291  97.002    45.9 1.718e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
      Df Sum Sq Mean Sq F value     Pr(>F)
treat  3    291  97.002    45.9 1.718e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error  t value  Pr(>|t|)
(Intercept)     48.7    0.65013 74.9085 < 2.2e-16 ***
treatA         -10.0    0.97519 -10.2544 6.837e-08 ***
```

```
treatB          -3.7    0.97519  -3.7941  0.001974 **
treatC           0.1    0.91942   0.1088  0.914933
treatD           0.0    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.2   Chapter 3

10.2.1   p63

(160) MODEL

```
GLM(CO ~ Eth + Ratio + Eth:Ratio, COdata) # OK
```

```
$ANOVA
Response : CO
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            8 1654.0 206.750  40.016 3.861e-06 ***
RESIDUALS        9   46.5   5.167
CORRECTED TOTAL 17 1700.5
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
          Df Sum Sq Mean Sq F value    Pr(>F)
Eth        2    324   162.0  31.355 8.790e-05 ***
Ratio      2    652   326.0  63.097 5.067e-06 ***
Eth:Ratio  4    678   169.5  32.806 2.240e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
          Df Sum Sq Mean Sq F value    Pr(>F)
Eth        2    324   162.0  31.355 8.790e-05 ***
Ratio      2    652   326.0  63.097 5.067e-06 ***
Eth:Ratio  4    678   169.5  32.806 2.240e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
          Df Sum Sq Mean Sq F value    Pr(>F)
Eth        2    324   162.0  31.355 8.790e-05 ***
Ratio      2    652   326.0  63.097 5.067e-06 ***
Eth:Ratio  4    678   169.5  32.806 2.240e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
                Estimate Std. Error  t value  Pr(>|t|)
(Intercept)         59.0     1.6073  36.7081 4.094e-11 ***
Eth0.1               8.0     2.2730   3.5195 0.0065202 **
Eth0.2               8.5     2.2730   3.7395 0.0046291 **
Eth0.3               0.0     0.0000
Ratio14             33.0     2.2730  14.5181 1.498e-07 ***
Ratio15             17.5     2.2730   7.6990 3.003e-05 ***
Ratio16              0.0     0.0000
Eth0.1:Ratio14     -36.0     3.2146 -11.1991 1.384e-06 ***
Eth0.1:Ratio15     -15.0     3.2146  -4.6663 0.0011747 **
Eth0.1:Ratio16       0.0     0.0000
Eth0.2:Ratio14     -21.0     3.2146  -6.5328 0.0001073 ***
Eth0.2:Ratio15      -4.5     3.2146  -1.3999 0.1950620
Eth0.2:Ratio16       0.0     0.0000
Eth0.3:Ratio14       0.0     0.0000
Eth0.3:Ratio15       0.0     0.0000
Eth0.3:Ratio16       0.0     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(161) MODEL

```
GLM(CO ~ Ratio + Eth + Ratio:Eth, COdata) # OK
```

```
$ANOVA
Response : CO
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            8 1654.0 206.750  40.016 3.861e-06 ***
RESIDUALS        9   46.5   5.167
CORRECTED TOTAL 17 1700.5
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
          Df Sum Sq Mean Sq F value    Pr(>F)
Ratio      2    652   326.0  63.097 5.067e-06 ***
Eth        2    324   162.0  31.355 8.790e-05 ***
Ratio:Eth  4    678   169.5  32.806 2.240e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
          Df Sum Sq Mean Sq F value    Pr(>F)
Ratio      2    652   326.0  63.097 5.067e-06 ***
Eth        2    324   162.0  31.355 8.790e-05 ***
```

```
Ratio:Eth   4     678    169.5  32.806 2.240e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
          Df Sum Sq Mean Sq F value    Pr(>F)
Ratio      2    652   326.0  63.097 5.067e-06 ***
Eth        2    324   162.0  31.355 8.790e-05 ***
Ratio:Eth  4    678   169.5  32.806 2.240e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
                Estimate Std. Error  t value  Pr(>|t|)
(Intercept)         59.0     1.6073  36.7081 4.094e-11 ***
Ratio14             33.0     2.2730  14.5181 1.498e-07 ***
Ratio15             17.5     2.2730   7.6990 3.003e-05 ***
Ratio16              0.0     0.0000
Eth0.1               8.0     2.2730   3.5195 0.0065202 **
Eth0.2               8.5     2.2730   3.7395 0.0046291 **
Eth0.3               0.0     0.0000
Ratio14:Eth0.1     -36.0     3.2146 -11.1991 1.384e-06 ***
Ratio14:Eth0.2     -21.0     3.2146  -6.5328 0.0001073 ***
Ratio14:Eth0.3       0.0     0.0000
Ratio15:Eth0.1     -15.0     3.2146  -4.6663 0.0011747 **
Ratio15:Eth0.2      -4.5     3.2146  -1.3999 0.1950620
Ratio15:Eth0.3       0.0     0.0000
Ratio16:Eth0.1       0.0     0.0000
Ratio16:Eth0.2       0.0     0.0000
Ratio16:Eth0.3       0.0     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.2.2 p74

(162) MODEL

```
GLM(CO ~ Eth + Ratio + Eth:Ratio, COdata[-18,]) # OK
```

```
$ANOVA
Response : CO
                 Df Sum Sq Mean Sq F value    Pr(>F)
MODEL             8 1423.0 177.879  31.978 2.749e-05 ***
RESIDUALS         8   44.5   5.563
CORRECTED TOTAL  16 1467.5
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
          Df Sum Sq Mean Sq F value    Pr(>F)
Eth        2 472.66  236.33  42.486 5.482e-05 ***
Ratio      2 395.33  197.66  35.535 0.0001048 ***
Eth:Ratio  4 555.04  138.76  24.945 0.0001427 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
          Df Sum Sq Mean Sq F value    Pr(>F)
Eth        2 398.26  199.13  35.799 0.0001020 ***
Ratio      2 395.33  197.66  35.535 0.0001048 ***
Eth:Ratio  4 555.04  138.76  24.945 0.0001427 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
          Df Sum Sq Mean Sq F value    Pr(>F)
Eth        2 319.45  159.73  28.715 0.0002235 ***
Ratio      2 511.45  255.73  45.973 4.105e-05 ***
Eth:Ratio  4 555.04  138.76  24.945 0.0001427 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
                Estimate Std. Error t value  Pr(>|t|)
(Intercept)         60.0     2.3585 25.4399 6.108e-09 ***
Eth0.1               7.0     2.8886  2.4234 0.0416315 *
Eth0.2               7.5     2.8886  2.5965 0.0317925 *
Eth0.3               0.0     0.0000
Ratio14             32.0     2.8886 11.0782 3.933e-06 ***
Ratio15             16.5     2.8886  5.7122 0.0004480 ***
Ratio16              0.0     0.0000
Eth0.1:Ratio14     -35.0     3.7291 -9.3856 1.360e-05 ***
Eth0.1:Ratio15     -14.0     3.7291 -3.7542 0.0055901 **
Eth0.1:Ratio16       0.0     0.0000
Eth0.2:Ratio14     -20.0     3.7291 -5.3632 0.0006751 ***
Eth0.2:Ratio15      -3.5     3.7291 -0.9386 0.3754235
Eth0.2:Ratio16       0.0     0.0000
Eth0.3:Ratio14       0.0     0.0000
Eth0.3:Ratio15       0.0     0.0000
Eth0.3:Ratio16       0.0     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.2.3   p91

(163) MODEL

```
volt$XA = (as.numeric(as.character(volt$A)) - 27)/5
volt$XB = (as.numeric(as.character(volt$B)) - 2.75)/2.25
volt$XC = (as.numeric(as.character(volt$C)) - 2.75)/2.25
GLM(y ~ XA + XB + XC + XA:XB + XA:XC + XB:XC + XA:XB:XC, volt) # OK
```

```
$ANOVA
Response : y
                 Df  Sum Sq Mean Sq F value Pr(>F)
MODEL             7  8843.4 1263.35  3.8686 0.0385 *
RESIDUALS         8  2612.5  326.56
CORRECTED TOTAL  15 11455.9
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
          Df Sum Sq Mean Sq F value    Pr(>F)
XA         1 4522.6  4522.6 13.8490 0.005859 **
XB         1   14.1    14.1  0.0431 0.840793
XC         1  473.1   473.1  1.4486 0.263154
XA:XB      1  715.6   715.6  2.1912 0.177071
XA:XC      1 2525.1  2525.1  7.7322 0.023899 *
XB:XC      1   52.6    52.6  0.1610 0.698780
XA:XB:XC   1  540.6   540.6  1.6553 0.234218
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
          Df Sum Sq Mean Sq F value    Pr(>F)
XA         1 4522.6  4522.6 13.8490 0.005859 **
XB         1   14.1    14.1  0.0431 0.840793
XC         1  473.1   473.1  1.4486 0.263154
XA:XB      1  715.6   715.6  2.1912 0.177071
XA:XC      1 2525.1  2525.1  7.7322 0.023899 *
XB:XC      1   52.6    52.6  0.1610 0.698780
XA:XB:XC   1  540.6   540.6  1.6553 0.234218
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
          Df Sum Sq Mean Sq F value    Pr(>F)
XA         1 4522.6  4522.6 13.8490 0.005859 **
XB         1   14.1    14.1  0.0431 0.840793
XC         1  473.1   473.1  1.4486 0.263154
```

```
XA:XB      1  715.6    715.6  2.1912 0.177071
XA:XC      1 2525.1   2525.1  7.7322 0.023899 *
XB:XC      1   52.6     52.6  0.1610 0.698780
XA:XB:XC 1  540.6    540.6  1.6553 0.234218
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error  t value  Pr(>|t|)
(Intercept)   668.56     4.5178 147.9854 4.885e-15 ***
XA            -16.81     4.5178  -3.7214  0.005859 **
XB              0.94     4.5178   0.2075  0.840793
XC              5.44     4.5178   1.2036  0.263154
XA:XB          -6.69     4.5178  -1.4803  0.177071
XA:XC          12.56     4.5178   2.7807  0.023899 *
XB:XC           1.81     4.5178   0.4012  0.698780
XA:XB:XC       -5.81     4.5178  -1.2866  0.234218
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.2.4   p97

(164) MODEL

```
chem2 = af(chem, c("A","B","C","D"))
GLM(y ~ A*B*C*D, chem2) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL           15 6369.4  424.63
RESIDUALS        0    0.0
CORRECTED TOTAL 15 6369.4

$`Type I`
        Df Sum Sq Mean Sq F value Pr(>F)
A        1  637.6   637.6
B        1 5076.6  5076.6
A:B      1  451.6   451.6
C        1    0.6     0.6
A:C      1   10.6    10.6
B:C      1    1.6     1.6
A:B:C    1    0.6     0.6
D        1    7.6     7.6
A:D      1   68.1    68.1
B:D      1    0.1     0.1
```

```
A:B:D    1    7.6      7.6
C:D      1    7.6      7.6
A:C:D    1   95.1     95.1
B:C:D    1    3.1      3.1
A:B:C:D  1    1.6      1.6


$`Type II`
        Df Sum Sq Mean Sq F value Pr(>F)
A        1  637.6   637.6
B        1 5076.6  5076.6
A:B      1  451.6   451.6
C        1    0.6     0.6
A:C      1   10.6    10.6
B:C      1    1.6     1.6
A:B:C    1    0.6     0.6
D        1    7.6     7.6
A:D      1   68.1    68.1
B:D      1    0.1     0.1
A:B:D    1    7.6     7.6
C:D      1    7.6     7.6
A:C:D    1   95.1    95.1
B:C:D    1    3.1     3.1
A:B:C:D  1    1.6     1.6


$`Type III`
        Df Sum Sq Mean Sq F value Pr(>F)
A        1  637.6   637.6
B        1 5076.6  5076.6
A:B      1  451.6   451.6
C        1    0.6     0.6
A:C      1   10.6    10.6
B:C      1    1.6     1.6
A:B:C    1    0.6     0.6
D        1    7.6     7.6
A:D      1   68.1    68.1
B:D      1    0.1     0.1
A:B:D    1    7.6     7.6
C:D      1    7.6     7.6
A:C:D    1   95.1    95.1
B:C:D    1    3.1     3.1
A:B:C:D  1    1.6     1.6


$Parameter
              Estimate Std. Error t value Pr(>|t|)
(Intercept)        72
A-1                15
A1                  0
B-1               -21
```

```
B1                        0
A-1:B-1                 -26
A-1:B1                    0
A1:B-1                    0
A1:B1                     0
C-1                      -3
C1                        0
A-1:C-1                  11
A-1:C1                    0
A1:C-1                    0
A1:C1                     0
B-1:C-1                  -5
B-1:C1                    0
B1:C-1                    0
B1:C1                     0
A-1:B-1:C-1               4
A-1:B-1:C1                0
A-1:B1:C-1               0
A-1:B1:C1                0
A1:B-1:C-1               0
A1:B-1:C1                0
A1:B1:C-1                0
A1:B1:C1                 0
D-1                      -6
D1                        0
A-1:D-1                  14
A-1:D1                    0
A1:D-1                    0
A1:D1                     0
B-1:D-1                  -6
B-1:D1                    0
B1:D-1                    0
B1:D1                     0
A-1:B-1:D-1               8
A-1:B-1:D1                0
A-1:B1:D-1               0
A-1:B1:D1                0
A1:B-1:D-1               0
A1:B-1:D1                0
A1:B1:D-1                0
A1:B1:D1                 0
C-1:D-1                   4
C-1:D1                    0
C1:D-1                    0
C1:D1                     0
A-1:C-1:D-1             -17
A-1:C-1:D1               0
A-1:C1:D-1              0
```

```
A-1:C1:D1                0
A1:C-1:D-1               0
A1:C-1:D1                0
A1:C1:D-1                0
A1:C1:D1                 0
B-1:C-1:D-1              6
B-1:C-1:D1               0
B-1:C1:D-1               0
B-1:C1:D1                0
B1:C-1:D-1               0
B1:C-1:D1                0
B1:C1:D-1                0
B1:C1:D1                 0
A-1:B-1:C-1:D-1         -5
A-1:B-1:C-1:D1           0
A-1:B-1:C1:D-1           0
A-1:B-1:C1:D1            0
A-1:B1:C-1:D-1           0
A-1:B1:C-1:D1            0
A-1:B1:C1:D-1            0
A-1:B1:C1:D1            0
A1:B-1:C-1:D-1           0
A1:B-1:C-1:D1            0
A1:B-1:C1:D-1           0
A1:B-1:C1:D1            0
A1:B1:C-1:D-1           0
A1:B1:C-1:D1            0
A1:B1:C1:D-1            0
A1:B1:C1:D1            0
```

10.2.5 p104

(165) MODEL

```
GLM(y ~ A*B*C*D, BoxM) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL           15  207.1   13.807
RESIDUALS        0    0.0
CORRECTED TOTAL 15  207.1

$`Type I`
        Df Sum Sq Mean Sq F value Pr(>F)
A        1  2.560   2.560
```

```
B          1 71.234   71.234
A:B        1  3.312    3.312
C          1 55.056   55.056
A:C        1 24.800   24.800
B:C        1  2.560    2.560
A:B:C      1  5.760    5.760
D          1  4.080    4.080
A:D        1  1.346    1.346
B:D        1  5.570    5.570
A:B:D      1  2.074    2.074
C:D        1  8.880    8.880
A:C:D      1  0.640    0.640
B:C:D      1  9.986    9.986
A:B:C:D    1  9.242    9.242


$`Type II`
        Df Sum Sq Mean Sq F value Pr(>F)
A          1  2.560    2.560
B          1 71.234   71.234
A:B        1  3.312    3.312
C          1 55.056   55.056
A:C        1 24.800   24.800
B:C        1  2.560    2.560
A:B:C      1  5.760    5.760
D          1  4.080    4.080
A:D        1  1.346    1.346
B:D        1  5.570    5.570
A:B:D      1  2.074    2.074
C:D        1  8.880    8.880
A:C:D      1  0.640    0.640
B:C:D      1  9.986    9.986
A:B:C:D    1  9.242    9.242


$`Type III`
        Df Sum Sq Mean Sq F value Pr(>F)
A          1  2.560    2.560
B          1 71.234   71.234
A:B        1  3.312    3.312
C          1 55.056   55.056
A:C        1 24.800   24.800
B:C        1  2.560    2.560
A:B:C      1  5.760    5.760
D          1  4.080    4.080
A:D        1  1.346    1.346
B:D        1  5.570    5.570
A:B:D      1  2.074    2.074
C:D        1  8.880    8.880
A:C:D      1  0.640    0.640
```

```
B:C:D    1  9.986    9.986
A:B:C:D  1  9.242    9.242
```

```
$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   48.245
A             -0.400
B             -2.110
A:B            0.455
C              1.855
A:C           -1.245
B:C           -0.400
A:B:C          0.600
D              0.505
A:D           -0.290
B:D           -0.590
A:B:D          0.360
C:D            0.745
A:C:D          0.200
B:C:D         -0.790
A:B:C:D        0.760
```

10.3   Chapter 4

10.3.1   p122

(166) MODEL

```
GLM(rate ~ rat + dose, drug) # OK
```

```
$ANOVA
Response : rate
                Df  Sum Sq  Mean Sq F value    Pr(>F)
MODEL           13 2.12867 0.163744  19.613 1.59e-12 ***
RESIDUALS       36 0.30055 0.008349
CORRECTED TOTAL 49 2.42922
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
     Df  Sum Sq Mean Sq F value     Pr(>F)
rat   9 1.66846 0.18538  22.205 3.749e-12 ***
dose  4 0.46021 0.11505  13.781 6.535e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
     Df  Sum Sq Mean Sq F value    Pr(>F)
rat   9 1.66846 0.18538  22.205 3.749e-12 ***
dose  4 0.46021 0.11505  13.781 6.535e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
     Df  Sum Sq Mean Sq F value    Pr(>F)
rat   9 1.66846 0.18538  22.205 3.749e-12 ***
dose  4 0.46021 0.11505  13.781 6.535e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   1.1418   0.048349 23.6158 < 2.2e-16 ***
rat1         -0.5000   0.057788 -8.6523 2.559e-10 ***
rat10        -0.0840   0.057788 -1.4536 0.1547238
rat2         -0.5140   0.057788 -8.8946 1.289e-10 ***
rat3         -0.4880   0.057788 -8.4446 4.631e-10 ***
rat4         -0.3840   0.057788 -6.6450 9.638e-08 ***
rat5         -0.2180   0.057788 -3.7724 0.0005824 ***
rat6         -0.3720   0.057788 -6.4373 1.817e-07 ***
rat7         -0.2980   0.057788 -5.1568 9.298e-06 ***
rat8         -0.0600   0.057788 -1.0383 0.3060654
rat9          0.0000   0.000000
dose0        -0.0860   0.040862 -2.1046 0.0423697 *
dose0.5       0.0840   0.040862  2.0557 0.0471211 *
dose1         0.1640   0.040862  4.0135 0.0002899 ***
dose1.5       0.1590   0.040862  3.8911 0.0004137 ***
dose2         0.0000   0.000000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.3.2 p127

(167) MODEL

```
GLM(y ~ block + treat + strain + treat:strain, bha) # OK
```

```
$ANOVA
Response : y
            Df Sum Sq Mean Sq F value    Pr(>F)
MODEL        8 543.22  67.902  26.203 0.0001507 ***
RESIDUALS    7  18.14   2.591
```

```
CORRECTED TOTAL 15 561.36
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
            Df Sum Sq Mean Sq  F value    Pr(>F)
block        1  47.61   47.61  18.3721  0.003627 **
treat        1 422.30  422.30 162.9613 4.194e-06 ***
strain       3  32.96   10.99   4.2399  0.052741 .
treat:strain 3  40.34   13.45   5.1892  0.033685 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
            Df Sum Sq Mean Sq  F value    Pr(>F)
block        1  47.61   47.61  18.3721  0.003627 **
treat        1 422.30  422.30 162.9613 4.194e-06 ***
strain       3  32.96   10.99   4.2399  0.052741 .
treat:strain 3  40.34   13.45   5.1892  0.033685 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
            Df Sum Sq Mean Sq  F value    Pr(>F)
block        1  47.61   47.61  18.3721  0.003627 **
treat        1 422.30  422.30 162.9613 4.194e-06 ***
strain       3  32.96   10.99   4.2399  0.052741 .
treat:strain 3  40.34   13.45   5.1892  0.033685 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
                          Estimate Std. Error t value  Pr(>|t|)
(Intercept)                 13.875     1.2073 11.4922 8.495e-06 ***
block1                       3.450     0.8049  4.2863  0.003627 **
block2                       0.000     0.0000
treatcontrol                -6.650     1.6098 -4.1310  0.004399 **
treattreated                 0.000     0.0000
strain129Ola                 0.550     1.6098  0.3417  0.742635
strainA/J                    2.100     1.6098  1.3045  0.233308
strainBALB/c                 7.450     1.6098  4.6279  0.002404 **
strainNIH                    0.000     0.0000
treatcontrol:strain129Ola   -1.950     2.2766 -0.8565  0.420049
treatcontrol:strainA/J      -4.000     2.2766 -1.7570  0.122334
treatcontrol:strainBALB/c   -8.550     2.2766 -3.7556  0.007116 **
treatcontrol:strainNIH       0.000     0.0000
treattreated:strain129Ola    0.000     0.0000
treattreated:strainA/J       0.000     0.0000
```

```
treattreated:strainBALB/c      0.000      0.0000
treattreated:strainNIH         0.000      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.3.3   p129

(168) MODEL

```
GLM(cdistance ~ id + teehgt, rcb) # OK
```

```
$ANOVA
Response : cdistance
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           10 126465 12646.5  161.72 < 2.2e-16 ***
RESIDUALS      124   9697    78.2
CORRECTED TOTAL 134 136162
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
       Df Sum Sq Mean Sq F value    Pr(>F)
id      8 124741   15593 199.394 < 2.2e-16 ***
teehgt  2   1724     862  11.023 3.926e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
       Df Sum Sq Mean Sq F value    Pr(>F)
id      8 124741   15593 199.394 < 2.2e-16 ***
teehgt  2   1724     862  11.023 3.926e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
       Df Sum Sq Mean Sq F value    Pr(>F)
id      8 124741   15593 199.394 < 2.2e-16 ***
teehgt  2   1724     862  11.023 3.926e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error  t value  Pr(>|t|)
(Intercept)  240.440     2.5243  95.2517 < 2.2e-16 ***
id1          -92.907     3.2290 -28.7722 < 2.2e-16 ***
id2          -57.860     3.2290 -17.9186 < 2.2e-16 ***
```

```
id3            -92.907    3.2290 -28.7722 < 2.2e-16 ***
id4            -60.360    3.2290 -18.6928 < 2.2e-16 ***
id5            -22.267    3.2290  -6.8957 2.422e-10 ***
id6            -92.860    3.2290 -28.7577 < 2.2e-16 ***
id7            -66.720    3.2290 -20.6625 < 2.2e-16 ***
id8            -59.540    3.2290 -18.4389 < 2.2e-16 ***
id9              0.000    0.0000
teehgt1         -8.380    1.8643  -4.4950 1.575e-05 ***
teehgt2         -2.000    1.8643  -1.0728    0.2854
teehgt3          0.000    0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.3.4 p136

(169) MODEL

```
GLM(AUC ~ Subject + Period + Treat, bioeqv) # OK
```

```
$ANOVA
Response : AUC
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL            6 174461   29077  0.1315 0.9774
RESIDUALS        2 442158  221079
CORRECTED TOTAL  8 616618


$`Type I`
        Df Sum Sq Mean Sq F value Pr(>F)
Subject  2 114264   57132  0.2584 0.7946
Period   2  45196   22598  0.1022 0.9073
Treat    2  15000    7500  0.0339 0.9672


$`Type II`
        Df Sum Sq Mean Sq F value Pr(>F)
Subject  2 114264   57132  0.2584 0.7946
Period   2  45196   22598  0.1022 0.9073
Treat    2  15000    7500  0.0339 0.9672


$`Type III`
        Df Sum Sq Mean Sq F value Pr(>F)
Subject  2 114264   57132  0.2584 0.7946
Period   2  45196   22598  0.1022 0.9073
Treat    2  15000    7500  0.0339 0.9672


$Parameter
            Estimate Std. Error t value Pr(>|t|)
```

```
(Intercept)  1352.56     414.67  3.2618  0.08252 .
Subject1     -276.00     383.91 -0.7189  0.54684
Subject2     -138.33     383.91 -0.3603  0.75310
Subject3        0.00       0.00
Period1      -171.00     383.91 -0.4454  0.69959
Period2      -111.33     383.91 -0.2900  0.79912
Period3         0.00       0.00
TreatA         78.33     383.91  0.2040  0.85720
TreatB        -14.67     383.91 -0.0382  0.97300
TreatC          0.00       0.00
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.4   Chapter 5

10.4.1   p152

(170) MODEL

```
GLM(conc ~ lab, Apo) # OK
```

```
$ANOVA
Response : conc
                 Df    Sum Sq   Mean Sq F value     Pr(>F)
MODEL            3 0.092233 0.0307444   42.107 4.009e-10 ***
RESIDUALS       26 0.018984 0.0007302
CORRECTED TOTAL 29 0.111217
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
    Df   Sum Sq  Mean Sq F value    Pr(>F)
lab  3 0.092233 0.030744  42.107 4.009e-10 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
    Df   Sum Sq  Mean Sq F value    Pr(>F)
lab  3 0.092233 0.030744  42.107 4.009e-10 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
    Df   Sum Sq  Mean Sq F value    Pr(>F)
lab  3 0.092233 0.030744  42.107 4.009e-10 ***
---
```

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 1.16425 0.0095535 121.8661 < 2.2e-16 ***
labA   0.02661 0.0139849   1.9026   0.06823 .
labB   -0.00237 0.0135107 -0.1758   0.86182
labC   -0.12111 0.0139849 -8.6598 3.878e-09 ***
labD   0.00000 0.0000000

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

10.4.2 p181

(171) MODEL

```
GLM(residue ~ form + tech + form:tech + plot:form:tech, pesticide) # OK
```

```
$ANOVA
Response : residue
                 Df    Sum Sq   Mean Sq F value    Pr(>F)
MODEL             7 0.036857 0.0052653  11.804 0.001187 **
RESIDUALS         8 0.003569 0.0004461
CORRECTED TOTAL  15 0.040426
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
               Df    Sum Sq  Mean Sq F value     Pr(>F)
form            1 0.000018 0.000018  0.0405    0.84554
tech            1 0.032310 0.032310 72.4339 2.789e-05 ***
form:tech       1 0.002186 0.002186  4.8997    0.05776 .
form:tech:plot  4 0.002344 0.000586  1.3136    0.34317
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
               Df    Sum Sq  Mean Sq F value     Pr(>F)
form            1 0.000018 0.000018  0.0405    0.84554
tech            1 0.032310 0.032310 72.4339 2.789e-05 ***
form:tech       1 0.002186 0.002186  4.8997    0.05776 .
form:tech:plot  4 0.002344 0.000586  1.3136    0.34317
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
```

```
                 Df   Sum Sq  Mean Sq F value    Pr(>F)
form           1 0.000018 0.000018   0.0405   0.84554
tech           1 0.032310 0.032310 72.4339 2.789e-05 ***
form:tech      1 0.002186 0.002186   4.8997   0.05776 .
form:tech:plot 4 0.002344 0.000586   1.3136   0.34317
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
                  Estimate Std. Error t value  Pr(>|t|)
(Intercept)         0.3410   0.014934 22.8334 1.435e-08 ***
formA               0.0225   0.021120  1.0653   0.31782
formB               0.0000   0.000000
tech1              -0.0470   0.021120 -2.2254   0.05671 .
tech2               0.0000   0.000000
formA:tech1        -0.0390   0.029868 -1.3057   0.22794
formA:tech2         0.0000   0.000000
formB:tech1         0.0000   0.000000
formB:tech2         0.0000   0.000000
formA:tech1:plot1  -0.0330   0.021120 -1.5625   0.15680
formA:tech1:plot2   0.0000   0.000000
formA:tech2:plot1   0.0215   0.021120  1.0180   0.33848
formA:tech2:plot2   0.0000   0.000000
formB:tech1:plot1  -0.0235   0.021120 -1.1127   0.29816
formB:tech1:plot2   0.0000   0.000000
formB:tech2:plot1   0.0155   0.021120  0.7339   0.48396
formB:tech2:plot2   0.0000   0.000000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.5   Chapter 7

10.5.1   p260

(172) MODEL

```
GLM(score ~ recipe + panelist, taste) # OK
```

```
$ANOVA
Response : score
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL           14 28.458 2.03274   2.661 0.0719 .
RESIDUALS        9  6.875 0.76389
CORRECTED TOTAL 23 35.333
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
         Df  Sum Sq Mean Sq F value   Pr(>F)
recipe    3 21.0000   7.000  9.1636 0.004246 **
panelist 11  7.4583   0.678  0.8876 0.581099
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
         Df Sum Sq Mean Sq F value  Pr(>F)
recipe    3 9.1250 3.04167  3.9818 0.04649 *
panelist 11 7.4583 0.67803  0.8876 0.58110
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
         Df Sum Sq Mean Sq F value  Pr(>F)
recipe    3 9.1250 3.04167  3.9818 0.04649 *
panelist 11 7.4583 0.67803  0.8876 0.58110
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   4.1875    0.69096  6.0604 0.0001881 ***
recipeA       0.6250    0.61802  1.0113 0.3382874
recipeB       1.3750    0.61802  2.2249 0.0531409 .
recipeC       2.0000    0.61802  3.2362 0.0102213 *
recipeD       0.0000    0.00000
panelist1    -0.1875    0.92702 -0.2023 0.8442116
panelist10    1.1250    0.97717  1.1513 0.2792820
panelist11    0.6250    0.92702  0.6742 0.5171250
panelist12    0.3125    0.92702  0.3371 0.7437697
panelist2     1.0000    0.92702  1.0787 0.3087732
panelist3     0.0000    0.87401  0.0000 1.0000000
panelist4     0.6250    0.97717  0.6396 0.5383692
panelist5     0.1250    0.92702  0.1348 0.8957058
panelist6     1.8125    0.92702  1.9552 0.0822793 .
panelist7     1.3125    0.92702  1.4158 0.1904906
panelist8     1.0000    0.92702  1.0787 0.3087732
panelist9     0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.5.2 p262

(173) MODEL

```
GLM(pressure ~ Block + Treatment, BPmonitor) # OK
```

```
$ANOVA
Response : pressure
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL            8 321.00  40.125  4.4174 0.1245
RESIDUALS        3  27.25   9.083
CORRECTED TOTAL 11 348.25


$`Type I`
          Df Sum Sq Mean Sq F value  Pr(>F)
Block      5  73.75  14.750  1.6239 0.36606
Treatment  3 247.25  82.417  9.0734 0.05149 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
          Df Sum Sq Mean Sq F value  Pr(>F)
Block      5  83.25  16.650  1.8330 0.32772
Treatment  3 247.25  82.417  9.0734 0.05149 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
          Df Sum Sq Mean Sq F value  Pr(>F)
Block      5  83.25  16.650  1.8330 0.32772
Treatment  3 247.25  82.417  9.0734 0.05149 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)    78.00     2.6101 29.8842 8.23e-05 ***
Block1          6.25     3.6912  1.6932  0.18899
Block2          2.75     3.6912  0.7450  0.51032
Block3          9.50     3.6912  2.5737  0.08223 .
Block4          3.50     3.6912  0.9482  0.41298
Block5          2.00     3.0139  0.6636  0.55439
Block6          0.00     0.0000
TreatmentA     -6.50     3.0139 -2.1567  0.11995
TreatmentB    -13.00     3.0139 -4.3134  0.02295 *
TreatmentC     -6.00     3.0139 -1.9908  0.14057
TreatmentP      0.00     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.5.3   p276

(174) MODEL

```
GLM(weight ~ Blocks + A + B + C + D + E + F + G + H, Bff) # OK
```

```
$ANOVA
Response : weight
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL           15 158.37  10.558
RESIDUALS        0   0.00
CORRECTED TOTAL 15 158.37


$`Type I`
       Df Sum Sq Mean Sq F value Pr(>F)
Blocks  7 30.567   4.367
A       1 21.879  21.879
B       1  8.338   8.338
C       1  6.213   6.213
D       1 12.870  12.870
E       1  0.098   0.098
F       1  1.260   1.260
G       1 71.868  71.868
H       1  5.279   5.279


$`Type II`
       Df Sum Sq Mean Sq F value Pr(>F)
Blocks  7 30.567   4.367
A       1 21.879  21.879
B       1  8.338   8.338
C       1  6.213   6.213
D       1 12.870  12.870
E       1  0.098   0.098
F       1  1.260   1.260
G       1 71.868  71.868
H       1  5.279   5.279


$`Type III`
       Df Sum Sq Mean Sq F value Pr(>F)
Blocks  7 30.567   4.367
A       1 21.879  21.879
B       1  8.338   8.338
C       1  6.213   6.213
D       1 12.870  12.870
E       1  0.098   0.098
F       1  1.260   1.260
G       1 71.868  71.868
```

```
H        1  5.279    5.279
```

$Parameter
```
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  10.2000
Blocks1      -3.0350
Blocks2       0.0900
Blocks3      -0.9600
Blocks4      -2.1700
Blocks5      -0.4600
Blocks6      -2.5200
Blocks7      -3.8200
Blocks8       0.0000
A-1          -2.3388
A1            0.0000
B-1           1.4437
B1            0.0000
C-1          -1.2463
C1            0.0000
D-1           1.7937
D1            0.0000
E-1          -0.1563
E1            0.0000
F-1           0.5612
F1            0.0000
G-1          -4.2388
G1            0.0000
H-1          -1.1488
H1            0.0000
```

10.6   Chapter 8

10.6.1   p315

(175) MODEL

```
GLM(ys ~ Block + A*B + Block:A:B + C*D + A:C + A:D + B:C + B:D + A:B:C + A:B:D +
        A:C:D + B:C:D + A:B:C:D, sausage) # OK
```

$ANOVA
Response : ys
```
                 Df    Sum Sq   Mean Sq F value    Pr(>F)
MODEL            19 0.064059 0.0033715  14.134 1.74e-05 ***
RESIDUALS        12 0.002862 0.0002385
CORRECTED TOTAL  31 0.066922
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
          Df  Sum Sq  Mean Sq  F value     Pr(>F)
Block      1 0.000903 0.000903   3.7860   0.075482 .
A          1 0.045753 0.045753 191.8035 9.647e-09 ***
B          1 0.002628 0.002628  11.0175   0.006119 **
A:B        1 0.001128 0.001128   4.7293   0.050371 .
Block:A:B  3 0.005484 0.001828   7.6638   0.004007 **
C          1 0.003828 0.003828  16.0480   0.001743 **
D          1 0.000528 0.000528   2.2140   0.162566
C:D        1 0.000253 0.000253   1.0611   0.323272
A:C        1 0.000153 0.000153   0.6419   0.438593
A:D        1 0.000903 0.000903   3.7860   0.075482 .
B:C        1 0.000078 0.000078   0.3275   0.577693
B:D        1 0.000253 0.000253   1.0611   0.323272
A:B:C      1 0.001378 0.001378   5.7773   0.033299 *
A:B:D      1 0.000703 0.000703   2.9476   0.111680
A:C:D      1 0.000028 0.000028   0.1179   0.737260
B:C:D      1 0.000028 0.000028   0.1179   0.737260
A:B:C:D    1 0.000028 0.000028   0.1179   0.737260
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
          Df  Sum Sq  Mean Sq  F value     Pr(>F)
Block      1 0.000903 0.000903   3.7860   0.075482 .
A          1 0.045753 0.045753 191.8035 9.647e-09 ***
B          1 0.002628 0.002628  11.0175   0.006119 **
A:B        1 0.001128 0.001128   4.7293   0.050371 .
Block:A:B  3 0.005484 0.001828   7.6638   0.004007 **
C          1 0.003828 0.003828  16.0480   0.001743 **
D          1 0.000528 0.000528   2.2140   0.162566
C:D        1 0.000253 0.000253   1.0611   0.323272
A:C        1 0.000153 0.000153   0.6419   0.438593
A:D        1 0.000903 0.000903   3.7860   0.075482 .
B:C        1 0.000078 0.000078   0.3275   0.577693
B:D        1 0.000253 0.000253   1.0611   0.323272
A:B:C      1 0.001378 0.001378   5.7773   0.033299 *
A:B:D      1 0.000703 0.000703   2.9476   0.111680
A:C:D      1 0.000028 0.000028   0.1179   0.737260
B:C:D      1 0.000028 0.000028   0.1179   0.737260
A:B:C:D    1 0.000028 0.000028   0.1179   0.737260
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
          Df   Sum Sq  Mean Sq  F value    Pr(>F)
```

```
Block       1 0.000903 0.000903   3.7860  0.075482 .
A           1 0.045753 0.045753 191.8035 9.647e-09 ***
B           1 0.002628 0.002628  11.0175  0.006119 **
A:B         1 0.001128 0.001128   4.7293  0.050371 .
Block:A:B   3 0.005484 0.001828   7.6638  0.004007 **
C           1 0.003828 0.003828  16.0480  0.001743 **
D           1 0.000528 0.000528   2.2140  0.162566
C:D         1 0.000253 0.000253   1.0611  0.323272
A:C         1 0.000153 0.000153   0.6419  0.438593
A:D         1 0.000903 0.000903   3.7860  0.075482 .
B:C         1 0.000078 0.000078   0.3275  0.577693
B:D         1 0.000253 0.000253   1.0611  0.323272
A:B:C       1 0.001378 0.001378   5.7773  0.033299 *
A:B:D       1 0.000703 0.000703   2.9476  0.111680
A:C:D       1 0.000028 0.000028   0.1179  0.737260
B:C:D       1 0.000028 0.000028   0.1179  0.737260
A:B:C:D     1 0.000028 0.000028   0.1179  0.737260
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
                Estimate Std. Error  t value   Pr(>|t|)
(Intercept)      1.98250   0.012210 162.3645 < 2.2e-16 ***
Block1          -0.02500   0.010921  -2.2891 0.0409950 *
Block2           0.00000   0.000000
A-1              0.02625   0.017268   1.5202 0.1543701
A1               0.00000   0.000000
B-1             -0.02125   0.017268  -1.2306 0.2420445
B1               0.00000   0.000000
A-1:B-1          0.08375   0.024420   3.4295 0.0049901 **
A-1:B1           0.00000   0.000000
A1:B-1           0.00000   0.000000
A1:B1            0.00000   0.000000
Block1:A-1:B-1   0.05250   0.015445   3.3992 0.0052775 **
Block1:A-1:B1    0.06750   0.015445   4.3704 0.0009115 ***
Block1:A1:B-1    0.02250   0.015445   1.4568 0.1708355
Block1:A1:B1     0.00000   0.000000
Block2:A-1:B-1   0.00000   0.000000
Block2:A-1:B1    0.00000   0.000000
Block2:A1:B-1    0.00000   0.000000
Block2:A1:B1     0.00000   0.000000
C-1              0.01000   0.015445   0.6475 0.5295218
C1               0.00000   0.000000
D-1              0.01500   0.015445   0.9712 0.3506179
D1               0.00000   0.000000
C-1:D-1          0.00000   0.021842   0.0000 1.0000000
C-1:D1           0.00000   0.000000
C1:D-1           0.00000   0.000000
```

```
C1:D1              0.00000    0.000000
A-1:C-1            0.01000    0.021842    0.4578 0.6552549
A-1:C1             0.00000    0.000000
A1:C-1             0.00000    0.000000
A1:C1              0.00000    0.000000
A-1:D-1           -0.01000    0.021842   -0.4578 0.6552549
A-1:D1             0.00000    0.000000
A1:D-1             0.00000    0.000000
A1:D1              0.00000    0.000000
B-1:C-1            0.02500    0.021842    1.1446 0.2747035
B-1:C1             0.00000    0.000000
B1:C-1             0.00000    0.000000
B1:C1              0.00000    0.000000
B-1:D-1            0.00000    0.021842    0.0000 1.0000000
B-1:D1             0.00000    0.000000
B1:D-1             0.00000    0.000000
B1:D1              0.00000    0.000000
A-1:B-1:C-1       -0.04500    0.030890   -1.4568 0.1708355
A-1:B-1:C1         0.00000    0.000000
A-1:B1:C-1         0.00000    0.000000
A-1:B1:C1          0.00000    0.000000
A1:B-1:C-1         0.00000    0.000000
A1:B-1:C1          0.00000    0.000000
A1:B1:C-1          0.00000    0.000000
A1:B1:C1           0.00000    0.000000
A-1:B-1:D-1       -0.03000    0.030890   -0.9712 0.3506179
A-1:B-1:D1         0.00000    0.000000
A-1:B1:D-1         0.00000    0.000000
A-1:B1:D1          0.00000    0.000000
A1:B-1:D-1         0.00000    0.000000
A1:B-1:D1          0.00000    0.000000
A1:B1:D-1          0.00000    0.000000
A1:B1:D1           0.00000    0.000000
A-1:C-1:D-1        0.01500    0.030890    0.4856 0.6359959
A-1:C-1:D1         0.00000    0.000000
A-1:C1:D-1         0.00000    0.000000
A-1:C1:D1          0.00000    0.000000
A1:C-1:D-1         0.00000    0.000000
A1:C-1:D1          0.00000    0.000000
A1:C1:D-1          0.00000    0.000000
A1:C1:D1           0.00000    0.000000
B-1:C-1:D-1        0.01500    0.030890    0.4856 0.6359959
B-1:C-1:D1         0.00000    0.000000
B-1:C1:D-1         0.00000    0.000000
B-1:C1:D1          0.00000    0.000000
B1:C-1:D-1         0.00000    0.000000
B1:C-1:D1          0.00000    0.000000
B1:C1:D-1          0.00000    0.000000
```

```
B1:C1:D1           0.00000    0.000000
A-1:B-1:C-1:D-1  -0.01500    0.043684   -0.3434 0.7372599
A-1:B-1:C-1:D1    0.00000    0.000000
A-1:B-1:C1:D-1    0.00000    0.000000
A-1:B-1:C1:D1     0.00000    0.000000
A-1:B1:C-1:D-1    0.00000    0.000000
A-1:B1:C-1:D1     0.00000    0.000000
A-1:B1:C1:D-1     0.00000    0.000000
A-1:B1:C1:D1      0.00000    0.000000
A1:B-1:C-1:D-1    0.00000    0.000000
A1:B-1:C-1:D1     0.00000    0.000000
A1:B-1:C1:D-1     0.00000    0.000000
A1:B-1:C1:D1      0.00000    0.000000
A1:B1:C-1:D-1     0.00000    0.000000
A1:B1:C-1:D1      0.00000    0.000000
A1:B1:C1:D-1      0.00000    0.000000
A1:B1:C1:D1       0.00000    0.000000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.6.2   p320

(176) MODEL

```
GLM(y ~ A*B*C*D*E, plasma) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL           31 6672.9  215.26
RESIDUALS        0    0.0
CORRECTED TOTAL 31 6672.9

$`Type I`
        Df   Sum Sq Mean Sq F value Pr(>F)
A        1 1118.65 1118.65
B        1  142.81  142.81
A:B      1  141.96  141.96
C        1   91.80   91.80
A:C      1   70.81   70.81
B:C      1    5.78    5.78
A:B:C    1   65.55   65.55
D        1 1824.08 1824.08
A:D      1 2194.53 2194.53
B:D      1   87.78   87.78
A:B:D    1   87.12   87.12
```

417

```
C:D         1   22.45   22.45
A:C:D       1   42.78   42.78
B:C:D       1   12.25   12.25
A:B:C:D     1  375.38  375.38
E           1   78.75   78.75
A:E         1  278.48  278.48
B:E         1    0.72    0.72
A:B:E       1    0.10    0.10
C:E         1    0.15    0.15
A:C:E       1    0.24    0.24
B:C:E       1    6.48    6.48
A:B:C:E     1    1.53    1.53
D:E         1    8.40    8.40
A:D:E       1    5.28    5.28
B:D:E       1    0.28    0.28
A:B:D:E     1    0.60    0.60
C:D:E       1    0.85    0.85
A:C:D:E     1    0.55    0.55
B:C:D:E     1    6.30    6.30
A:B:C:D:E   1    0.50    0.50

$`Type II`
          Df  Sum Sq Mean Sq F value Pr(>F)
A           1 1118.65 1118.65
B           1  142.81  142.81
A:B         1  141.96  141.96
C           1   91.80   91.80
A:C         1   70.81   70.81
B:C         1    5.78    5.78
A:B:C       1   65.55   65.55
D           1 1824.08 1824.08
A:D         1 2194.53 2194.53
B:D         1   87.78   87.78
A:B:D       1   87.12   87.12
C:D         1   22.45   22.45
A:C:D       1   42.78   42.78
B:C:D       1   12.25   12.25
A:B:C:D     1  375.38  375.38
E           1   78.75   78.75
A:E         1  278.48  278.48
B:E         1    0.72    0.72
A:B:E       1    0.10    0.10
C:E         1    0.15    0.15
A:C:E       1    0.24    0.24
B:C:E       1    6.48    6.48
A:B:C:E     1    1.53    1.53
D:E         1    8.40    8.40
A:D:E       1    5.28    5.28
```

```
B:D:E        1    0.28    0.28
A:B:D:E      1    0.60    0.60
C:D:E        1    0.85    0.85
A:C:D:E      1    0.55    0.55
B:C:D:E      1    6.30    6.30
A:B:C:D:E    1    0.50    0.50


$`Type III`
          Df  Sum Sq Mean Sq F value Pr(>F)
A          1 1118.64 1118.64
B          1  142.80  142.80
A:B        1  141.96  141.96
C          1   91.80   91.80
A:C        1   70.81   70.81
B:C        1    5.78    5.78
A:B:C      1   65.55   65.55
D          1 1824.08 1824.08
A:D        1 2194.53 2194.53
B:D        1   87.78   87.78
A:B:D      1   87.12   87.12
C:D        1   22.45   22.45
A:C:D      1   42.78   42.78
B:C:D      1   12.25   12.25
A:B:C:D    1  375.38  375.38
E          1   78.75   78.75
A:E        1  278.48  278.48
B:E        1    0.72    0.72
A:B:E      1    0.10    0.10
C:E        1    0.15    0.15
A:C:E      1    0.24    0.24
B:C:E      1    6.48    6.48
A:B:C:E    1    1.53    1.53
D:E        1    8.40    8.40
A:D:E      1    5.28    5.28
B:D:E      1    0.28    0.28
A:B:D:E    1    0.60    0.60
C:D:E      1    0.85    0.85
A:C:D:E    1    0.55    0.55
B:C:D:E    1    6.30    6.30
A:B:C:D:E  1    0.50    0.50


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)     48.2
A-             -24.3
A+               0.0
B-              -5.0
B+               0.0
```

```
A-:B-              4.8
A-:B+              0.0
A+:B-              0.0
A+:B+              0.0
C-               -10.4
C+                 0.0
A-:C-             19.5
A-:C+              0.0
A+:C-              0.0
A+:C+              0.0
B-:C-             23.4
B-:C+              0.0
B+:C-              0.0
B+:C+              0.0
A-:B-:C-         -38.1
A-:B-:C+           0.0
A-:B+:C-           0.0
A-:B+:C+           0.0
A+:B-:C-           0.0
A+:B-:C+           0.0
A+:B+:C-           0.0
A+:B+:C+           0.0
D-                -3.8
D+                 0.0
A-:D-             34.5
A-:D+              0.0
A+:D-              0.0
A+:D+              0.0
B-:D-              5.4
B-:D+              0.0
B+:D-              0.0
B+:D+              0.0
A-:B-:D-         -16.3
A-:B-:D+           0.0
A-:B+:D-           0.0
A-:B+:D+           0.0
A+:B-:D-           0.0
A+:B-:D+           0.0
A+:B+:D-           0.0
A+:B+:D+           0.0
C-:D-             17.3
C-:D+              0.0
C+:D-              0.0
C+:D+              0.0
A-:C-:D-         -18.1
A-:C-:D+           0.0
A-:C+:D-           0.0
A-:C+:D+           0.0
```

```
A+:C-:D-            0.0
A+:C-:D+            0.0
A+:C+:D-            0.0
A+:C+:D+            0.0
B-:C-:D-          -36.9
B-:C-:D+            0.0
B-:C+:D-            0.0
B-:C+:D+            0.0
B+:C-:D-            0.0
B+:C-:D+            0.0
B+:C+:D-            0.0
B+:C+:D+            0.0
A-:B-:C-:D-        56.8
A-:B-:C-:D+         0.0
A-:B-:C+:D-         0.0
A-:B-:C+:D+         0.0
A-:B+:C-:D-         0.0
A-:B+:C-:D+         0.0
A-:B+:C+:D-         0.0
A-:B+:C+:D+         0.0
A+:B-:C-:D-         0.0
A+:B-:C-:D+         0.0
A+:B-:C+:D-         0.0
A+:B-:C+:D+         0.0
A+:B+:C-:D-         0.0
A+:B+:C-:D+         0.0
A+:B+:C+:D-         0.0
A+:B+:C+:D+         0.0
E-                  1.3
E+                  0.0
A-:E-             -13.9
A-:E+               0.0
A+:E-               0.0
A+:E+               0.0
B-:E-               3.0
B-:E+               0.0
B+:E-               0.0
B+:E+               0.0
A-:B-:E-           -0.8
A-:B-:E+            0.0
A-:B+:E-            0.0
A-:B+:E+            0.0
A+:B-:E-            0.0
A+:B-:E+            0.0
A+:B+:E-            0.0
A+:B+:E+            0.0
C-:E-               2.7
C-:E+               0.0
```

```
C+:E-                0.0
C+:E+                0.0
A-:C-:E-             2.5
A-:C-:E+             0.0
A-:C+:E-             0.0
A-:C+:E+             0.0
A+:C-:E-             0.0
A+:C-:E+             0.0
A+:C+:E-             0.0
A+:C+:E+             0.0
B-:C-:E-            -6.4
B-:C-:E+             0.0
B-:C+:E-             0.0
B-:C+:E+             0.0
B+:C-:E-             0.0
B+:C-:E+             0.0
B+:C+:E-             0.0
B+:C+:E+             0.0
A-:B-:C-:E-         -1.5
A-:B-:C-:E+          0.0
A-:B-:C+:E-          0.0
A-:B-:C+:E+          0.0
A-:B+:C-:E-          0.0
A-:B+:C-:E+          0.0
A-:B+:C+:E-          0.0
A-:B+:C+:E+          0.0
A+:B-:C-:E-          0.0
A+:B-:C-:E+          0.0
A+:B-:C+:E-          0.0
A+:B-:C+:E+          0.0
A+:B+:C-:E-          0.0
A+:B+:C-:E+          0.0
A+:B+:C+:E-          0.0
A+:B+:C+:E+          0.0
D-:E-                3.0
D-:E+                0.0
D+:E-                0.0
D+:E+                0.0
A-:D-:E-             2.2
A-:D-:E+             0.0
A-:D+:E-             0.0
A-:D+:E+             0.0
A+:D-:E-             0.0
A+:D-:E+             0.0
A+:D+:E-             0.0
A+:D+:E+             0.0
B-:D-:E-            -4.9
B-:D-:E+             0.0
```

```
B-:D+:E-          0.0
B-:D+:E+          0.0
B+:D-:E-          0.0
B+:D-:E+          0.0
B+:D+:E-          0.0
B+:D+:E+          0.0
A-:B-:D-:E-       4.2
A-:B-:D-:E+       0.0
A-:B-:D+:E-       0.0
A-:B-:D+:E+       0.0
A-:B+:D-:E-       0.0
A-:B+:D-:E+       0.0
A-:B+:D+:E-       0.0
A-:B+:D+:E+       0.0
A+:B-:D-:E-       0.0
A+:B-:D-:E+       0.0
A+:B-:D+:E-       0.0
A+:B-:D+:E+       0.0
A+:B+:D-:E-       0.0
A+:B+:D-:E+       0.0
A+:B+:D+:E-       0.0
A+:B+:D+:E+       0.0
C-:D-:E-          -4.8
C-:D-:E+          0.0
C-:D+:E-          0.0
C-:D+:E+          0.0
C+:D-:E-          0.0
C+:D-:E+          0.0
C+:D+:E-          0.0
C+:D+:E+          0.0
A-:C-:D-:E-       -0.1
A-:C-:D-:E+       0.0
A-:C-:D+:E-       0.0
A-:C-:D+:E+       0.0
A-:C+:D-:E-       0.0
A-:C+:D-:E+       0.0
A-:C+:D+:E-       0.0
A-:C+:D+:E+       0.0
A+:C-:D-:E-       0.0
A+:C-:D-:E+       0.0
A+:C-:D+:E-       0.0
A+:C-:D+:E+       0.0
A+:C+:D-:E-       0.0
A+:C+:D-:E+       0.0
A+:C+:D+:E-       0.0
A+:C+:D+:E+       0.0
B-:C-:D-:E-       9.1
B-:C-:D-:E+       0.0
```

```
B-:C-:D+:E-          0.0
B-:C-:D+:E+          0.0
B-:C+:D-:E-          0.0
B-:C+:D-:E+          0.0
B-:C+:D+:E-          0.0
B-:C+:D+:E+          0.0
B+:C-:D-:E-          0.0
B+:C-:D-:E+          0.0
B+:C-:D+:E-          0.0
B+:C-:D+:E+          0.0
B+:C+:D-:E-          0.0
B+:C+:D-:E+          0.0
B+:C+:D+:E-          0.0
B+:C+:D+:E+          0.0
A-:B-:C-:D-:E-       -4.0
A-:B-:C-:D-:E+        0.0
A-:B-:C-:D+:E-        0.0
A-:B-:C-:D+:E+        0.0
A-:B-:C+:D-:E-        0.0
A-:B-:C+:D-:E+        0.0
A-:B-:C+:D+:E-        0.0
A-:B-:C+:D+:E+        0.0
A-:B+:C-:D-:E-        0.0
A-:B+:C-:D-:E+        0.0
A-:B+:C-:D+:E-        0.0
A-:B+:C-:D+:E+        0.0
A-:B+:C+:D-:E-        0.0
A-:B+:C+:D-:E+        0.0
A-:B+:C+:D+:E-        0.0
A-:B+:C+:D+:E+        0.0
A+:B-:C-:D-:E-        0.0
A+:B-:C-:D-:E+        0.0
A+:B-:C-:D+:E-        0.0
A+:B-:C-:D+:E+        0.0
A+:B-:C+:D-:E-        0.0
A+:B-:C+:D-:E+        0.0
A+:B-:C+:D+:E-        0.0
A+:B-:C+:D+:E+        0.0
A+:B+:C-:D-:E-        0.0
A+:B+:C-:D-:E+        0.0
A+:B+:C-:D+:E-        0.0
A+:B+:C-:D+:E+        0.0
A+:B+:C+:D-:E-        0.0
A+:B+:C+:D-:E+        0.0
A+:B+:C+:D+:E-        0.0
A+:B+:C+:D+:E+        0.0
```

10.6.3 p335

(177) MODEL

```
gear$A = as.numeric(as.character(gear$A))
gear$B = as.numeric(as.character(gear$B))
gear$C = as.numeric(as.character(gear$C))
gear$P = as.numeric(as.character(gear$P))
gear$Q = as.numeric(as.character(gear$Q))
REG(y ~ A*B*C + P + Q + A:P + A:Q + B:P + B:Q + C:P + C:Q, gear) # OK
```

```
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  15.4062
A            -4.9062
B            -0.1562
A:B           0.5312
C             3.9688
A:C           2.9062
B:C           0.4062
A:B:C         0.5938
P            -2.3438
Q            -3.4062
A:P          -0.9062
A:Q          -0.3438
B:P           1.0938
B:Q           0.1562
C:P          -0.2812
C:Q           0.7812
```

10.7 Chapter 9

10.7.1 p349

(178) MODEL

```
GLM(pl ~ Subject + Period + Treat, antifungal) # OK
```

```
$ANOVA
Response : pl
                Df  Sum Sq Mean Sq F value Pr(>F)
MODEL           18 118.558  6.5866  1.4435 0.2388
RESIDUALS       15  68.444  4.5630
CORRECTED TOTAL 33 187.002
```

```
$`Type I`
```

```
        Df  Sum Sq Mean Sq F value Pr(>F)
Subject 16 114.642  7.1651  1.5703 0.1942
Period   1   0.922  0.9224  0.2021 0.6594
Treat    1   2.993  2.9932  0.6560 0.4306


$`Type II`
        Df  Sum Sq Mean Sq F value Pr(>F)
Subject 16 114.642  7.1651  1.5703 0.1942
Period   1   0.734  0.7344  0.1609 0.6939
Treat    1   2.993  2.9932  0.6560 0.4306


$`Type III`
        Df  Sum Sq Mean Sq F value Pr(>F)
Subject 16 114.642  7.1651  1.5703 0.1942
Period   1   0.734  0.7344  0.1609 0.6939
Treat    1   2.993  2.9932  0.6560 0.4306


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  14.2500    1.60208  8.8947 2.28e-07 ***
Subject1     -2.8000    2.13611 -1.3108  0.20964
Subject10     0.8500    2.13611  0.3979  0.69630
Subject11    -1.2000    2.13611 -0.5618  0.58257
Subject12    -1.8500    2.13611 -0.8661  0.40010
Subject13    -5.3000    2.13611 -2.4811  0.02543 *
Subject14    -1.1000    2.13611 -0.5150  0.61409
Subject15    -1.0000    2.13611 -0.4681  0.64641
Subject16    -1.9000    2.13611 -0.8895  0.38779
Subject17    -2.3500    2.13611 -1.1001  0.28862
Subject2     -3.9000    2.13611 -1.8257  0.08786 .
Subject3      0.4000    2.13611  0.1873  0.85397
Subject4     -1.9000    2.13611 -0.8895  0.38779
Subject5      0.4500    2.13611  0.2107  0.83598
Subject6      2.9000    2.13611  1.3576  0.19466
Subject7     -0.9000    2.13611 -0.4213  0.67949
Subject8     -1.5000    2.13611 -0.7022  0.49330
Subject9      0.0000    0.00000
Period1      -0.2944    0.73395 -0.4012  0.69395
Period2       0.0000    0.00000
TreatA        0.5944    0.73395  0.8099  0.43065
TreatB        0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.7.2 p355

(179) MODEL

```
GLM(y ~ Group + Subject:Group + Period + Treat + Carry, bioequiv) # OK
```

$ANOVA
Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	39	417852	10714.1	20.367	< 2.2e-16 ***
RESIDUALS	68	35772	526.1		
CORRECTED TOTAL	107	453624			

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group	1	43335	43335	82.3763	2.46e-13 ***
Group:Subject	34	370970	10911	20.7406	< 2.2e-16 ***
Period	2	287	143	0.2723	0.7624
Treat	1	2209	2209	4.1993	0.0443 *
Carry	1	1051	1051	1.9970	0.1622

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group	1	32616	32616	61.9998	3.712e-11 ***
Group:Subject	34	370970	10911	20.7406	< 2.2e-16 ***
Period	1	38	38	0.0724	0.7888
Treat	1	2209	2209	4.1993	0.0443 *
Carry	1	1051	1051	1.9970	0.1622

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group	1	32616	32616	61.9998	3.712e-11 ***
Group:Subject	34	370970	10911	20.7406	< 2.2e-16 ***
Period	1	38	38	0.0724	0.7888
Treat	1	2209	2209	4.1993	0.0443 *
Carry	1	1051	1051	1.9970	0.1622

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	73.354	14.2178	5.1593	2.328e-06 ***
Group1	-33.108	18.7922	-1.7618	0.0825981 .
Group2	0.000	0.0000		

427

```
Group1:Subject1        0.000      0.0000
Group1:Subject10      21.583     18.7273   1.1525 0.2531475
Group1:Subject11       0.000      0.0000
Group1:Subject12       6.513     18.7273   0.3478 0.7290650
Group1:Subject120      0.000      0.0000
Group1:Subject122      0.000      0.0000
Group1:Subject129    295.857     18.7273  15.7982 < 2.2e-16 ***
Group1:Subject13      51.330     18.7273   2.7409 0.0078203 **
Group1:Subject14      81.637     18.7273   4.3592 4.525e-05 ***
Group1:Subject15       0.000      0.0000
Group1:Subject16       0.000      0.0000
Group1:Subject17       0.000      0.0000
Group1:Subject18      39.050     18.7273   2.0852 0.0408080 *
Group1:Subject19     128.193     18.7273   6.8453 2.692e-09 ***
Group1:Subject2       68.827     18.7273   3.6752 0.0004699 ***
Group1:Subject21      99.603     18.7273   5.3186 1.259e-06 ***
Group1:Subject23      13.113     18.7273   0.7002 0.4861744
Group1:Subject24       0.000      0.0000
Group1:Subject25       0.000      0.0000
Group1:Subject26     120.237     18.7273   6.4204 1.544e-08 ***
Group1:Subject27       0.000      0.0000
Group1:Subject28      71.333     18.7273   3.8091 0.0003023 ***
Group1:Subject3      118.143     18.7273   6.3086 2.437e-08 ***
Group1:Subject30       0.000      0.0000
Group1:Subject31      64.077     18.7273   3.4216 0.0010576 **
Group1:Subject32       0.000      0.0000
Group1:Subject33       0.000      0.0000
Group1:Subject34      87.123     18.7273   4.6522 1.566e-05 ***
Group1:Subject35       0.000      0.0000
Group1:Subject36      59.030     18.7273   3.1521 0.0024117 **
Group1:Subject4        0.000      0.0000
Group1:Subject5        0.000      0.0000
Group1:Subject6      255.517     18.7273  13.6441 < 2.2e-16 ***
Group1:Subject7        0.000      0.0000
Group1:Subject8        0.000      0.0000
Group1:Subject9        0.000      0.0000
Group2:Subject1      -25.410     18.7273  -1.3568 0.1793175
Group2:Subject10       0.000      0.0000
Group2:Subject11      89.713     18.7273   4.7905 9.386e-06 ***
Group2:Subject12       0.000      0.0000
Group2:Subject120     -1.477     18.7273  -0.0789 0.9373826
Group2:Subject122    -13.143     18.7273  -0.7018 0.4851810
Group2:Subject129      0.000      0.0000
Group2:Subject13       0.000      0.0000
Group2:Subject14       0.000      0.0000
Group2:Subject15     -14.143     18.7273  -0.7552 0.4527207
Group2:Subject16      33.980     18.7273   1.8145 0.0740168 .
Group2:Subject17      -8.603     18.7273  -0.4594 0.6474110
```

```
Group2:Subject18      0.000      0.0000
Group2:Subject19      0.000      0.0000
Group2:Subject2       0.000      0.0000
Group2:Subject21      0.000      0.0000
Group2:Subject23      0.000      0.0000
Group2:Subject24     12.570     18.7273  0.6712 0.5043579
Group2:Subject25     24.550     18.7273  1.3109 0.1942936
Group2:Subject26      0.000      0.0000
Group2:Subject27     16.420     18.7273  0.8768 0.3836841
Group2:Subject28      0.000      0.0000
Group2:Subject3       0.000      0.0000
Group2:Subject30    -10.803     18.7273 -0.5769 0.5659271
Group2:Subject31      0.000      0.0000
Group2:Subject32     45.127     18.7273  2.4097 0.0186785 *
Group2:Subject33     26.007     18.7273  1.3887 0.1694539
Group2:Subject34      0.000      0.0000
Group2:Subject35      1.150     18.7273  0.0614 0.9512146
Group2:Subject36      0.000      0.0000
Group2:Subject4      83.883     18.7273  4.4792 2.941e-05 ***
Group2:Subject5      54.280     18.7273  2.8984 0.0050436 **
Group2:Subject6       0.000      0.0000
Group2:Subject7       7.560     18.7273  0.4037 0.6877076
Group2:Subject8       0.000      0.0000
Group2:Subject9       0.000      0.0000
Period1              -1.329      6.0442 -0.2199 0.8265839
Period2              -1.454      5.4061 -0.2690 0.7887545
Period3               0.000      0.0000
TreatA               -9.594      4.6818 -2.0492 0.0443021 *
TreatB                0.000      0.0000
CarryA               -7.640      5.4061 -1.4132 0.1621674
CarryB                0.000      0.0000
Carrynone             0.000      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(180) MODEL

```
GLM(y ~ Subject + Period + Treat + Carry, bioequiv) # OK
```

```
$ANOVA
Response : y
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           39 417852 10714.1  20.367 < 2.2e-16 ***
RESIDUALS       68  35772   526.1
CORRECTED TOTAL 107 453624
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
       Df Sum Sq Mean Sq F value Pr(>F)
Subject 35 414306 11837.3 22.5016 <2e-16 ***
Period   2    287   143.3  0.2723 0.7624
Treat    1   2209  2209.1  4.1993 0.0443 *
Carry    1   1051  1050.6  1.9970 0.1622
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
       Df Sum Sq Mean Sq F value Pr(>F)
Subject 35 403586 11531.0 21.9194 <2e-16 ***
Period   1     38    38.1  0.0724 0.7888
Treat    1   2209  2209.1  4.1993 0.0443 *
Carry    1   1051  1050.6  1.9970 0.1622
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
CAUTION: Singularity Exists !
       Df Sum Sq Mean Sq F value Pr(>F)
Subject 35 403586 11531.0 21.9194 <2e-16 ***
Period   1     38    38.1  0.0724 0.7888
Treat    1   2209  2209.1  4.1993 0.0443 *
Carry    1   1051  1050.6  1.9970 0.1622
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)   73.354    14.2178  5.1593 2.328e-06 ***
Subject1     -25.410    18.7273 -1.3568 0.1793175
Subject10    -11.525    18.7922 -0.6133 0.5417437
Subject11     89.713    18.7273  4.7905 9.386e-06 ***
Subject12    -26.595    18.7922 -1.4152 0.1615734
Subject120    -1.477    18.7273 -0.0789 0.9373826
Subject122   -13.143    18.7273 -0.7018 0.4851810
Subject129   262.749    18.7922 13.9818 < 2.2e-16 ***
Subject13     18.222    18.7922  0.9697 0.3356530
Subject14     48.529    18.7922  2.5824 0.0119693 *
Subject15    -14.143    18.7273 -0.7552 0.4527207
Subject16     33.980    18.7273  1.8145 0.0740168 .
Subject17     -8.603    18.7273 -0.4594 0.6474110
Subject18      5.942    18.7922  0.3162 0.7528230
Subject19     95.085    18.7922  5.0598 3.404e-06 ***
Subject2      35.719    18.7922  1.9007 0.0615781 .
Subject21     66.495    18.7922  3.5385 0.0007307 ***
```

```
Subject23   -19.995    18.7922 -1.0640 0.2910971
Subject24    12.570    18.7273  0.6712 0.5043579
Subject25    24.550    18.7273  1.3109 0.1942936
Subject26    87.129    18.7922  4.6364 1.659e-05 ***
Subject27    16.420    18.7273  0.8768 0.3836841
Subject28    38.225    18.7922  2.0341 0.0458438 *
Subject3     85.035    18.7922  4.5250 2.492e-05 ***
Subject30   -10.803    18.7273 -0.5769 0.5659271
Subject31    30.969    18.7922  1.6480 0.1039753
Subject32    45.127    18.7273  2.4097 0.0186785 *
Subject33    26.007    18.7273  1.3887 0.1694539
Subject34    54.015    18.7922  2.8744 0.0053990 **
Subject35     1.150    18.7273  0.0614 0.9512146
Subject36    25.922    18.7922  1.3794 0.1722900
Subject4     83.883    18.7273  4.4792 2.941e-05 ***
Subject5     54.280    18.7273  2.8984 0.0050436 **
Subject6    222.409    18.7922 11.8352 < 2.2e-16 ***
Subject7      7.560    18.7273  0.4037 0.6877076
Subject8    -33.108    18.7922 -1.7618 0.0825981 .
Subject9      0.000     0.0000
Period1      -1.329     6.0442 -0.2199 0.8265839
Period2      -1.454     5.4061 -0.2690 0.7887545
Period3       0.000     0.0000
TreatA       -9.594     4.6818 -2.0492 0.0443021 *
TreatB        0.000     0.0000
CarryA       -7.640     5.4061 -1.4132 0.1621674
CarryB        0.000     0.0000
Carrynone     0.000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.7.3   p361

(181) MODEL

```
GLM(Time ~ Subject + Period + Treat + Carry, chipman) # OK
```

```
$ANOVA
Response : Time
                Df  Sum Sq Mean Sq F value    Pr(>F)
MODEL           17 28.0757 1.65151  64.421 1.139e-12 ***
RESIDUALS       18  0.4615 0.02564
CORRECTED TOTAL 35 28.5372
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
        Df  Sum Sq Mean Sq F value    Pr(>F)
Subject 11 24.2084 2.20076 85.8462 3.157e-13 ***
Period   2  3.2065 1.60325 62.5388 7.894e-09 ***
Treat    2  0.4276 0.21382  8.3406  0.002733 **
Carry    2  0.2332 0.11660  4.5484  0.025188 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
        Df  Sum Sq Mean Sq F value    Pr(>F)
Subject 11 24.2547 2.20497 86.0105 3.104e-13 ***
Period   1  0.0018 0.00184  0.0717 0.7919554
Treat    2  0.6392 0.31958 12.4661 0.0004003 ***
Carry    2  0.2332 0.11660  4.5484 0.0251881 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
CAUTION: Singularity Exists !
        Df  Sum Sq Mean Sq F value    Pr(>F)
Subject 11 24.2547 2.20497 86.0105 3.104e-13 ***
Period   1  0.0018 0.00184  0.0717 0.7919554
Treat    2  0.6392 0.31958 12.4661 0.0004003 ***
Carry    2  0.2332 0.11660  4.5484 0.0251881 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value   Pr(>|t|)
(Intercept)   5.6937   0.126580 44.9813 < 2.2e-16 ***
Subject1     -0.3733   0.130732 -2.8557 0.0105016 *
Subject10     1.6733   0.130732 12.7998 1.774e-10 ***
Subject11     0.3413   0.134755  2.5324 0.0208536 *
Subject12     1.5446   0.134755 11.4622 1.052e-09 ***
Subject2      0.0533   0.130732  0.4080 0.6881142
Subject3      1.9646   0.134755 14.5789 2.074e-11 ***
Subject4      0.3746   0.134755  2.7797 0.0123616 *
Subject5      1.9067   0.134755 14.1491 3.411e-11 ***
Subject6      1.2400   0.134755  9.2019 3.162e-08 ***
Subject7     -0.1500   0.134755 -1.1131 0.2802970
Subject8      0.1700   0.134755  1.2615 0.2232156
Subject9      0.0000   0.000000
Period1       0.4550   0.086471  5.2619 5.286e-05 ***
Period2      -0.0175   0.065366 -0.2677 0.7919554
Period3       0.0000   0.000000
Treat1       -0.2654   0.073081 -3.6318 0.0019073 **
Treat2       -0.3496   0.073081 -4.7835 0.0001487 ***
```

```
Treat3        0.0000   0.000000
Carry0        0.0000   0.000000
Carry1       -0.2337   0.098049 -2.3840 0.0283404 *
Carry2       -0.2737   0.098049 -2.7920 0.0120418 *
Carry3        0.0000   0.000000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.7.4   p372

(182) MODEL

```
residue$lc1 = log(residue$X1)
residue$lc2 = log(residue$X2)
residue$lc3 = log(residue$X3)
residue$lc4 = log(residue$X4)
residue$lc5 = log(residue$X5)
residue$sp = 7*residue$lc2+ 14*residue$lc3 + 30*residue$lc4 + 60*residue$lc5
residue$sm = residue$lc1 + residue$lc2+ residue$lc3 + residue$lc4 + residue$lc5
residue$num = 5*residue$sp - 111*residue$sm
residue$den = 5*4745 - 111^2
residue$k = residue$num/residue$den
residue$HL = -log(2)/residue$k
residue$logHL = log(residue$HL)
GLM(logHL ~ temp*moisture*soil, residue) # OK
```

```
$ANOVA
Response : logHL
                Df Sum Sq Mean Sq F value    Pr(>F)
MODEL            7 7.5133 1.07332  13.543 0.0007329 ***
RESIDUALS        8 0.6340 0.07925
CORRECTED TOTAL 15 8.1473
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
                  Df Sum Sq Mean Sq F value    Pr(>F)
temp               1 6.0503  6.0503 76.3427 2.303e-05 ***
moisture           1 0.9521  0.9521 12.0134  0.008492 **
temp:moisture      1 0.0013  0.0013  0.0162  0.901779
soil               1 0.4098  0.4098  5.1712  0.052559 .
temp:soil          1 0.0086  0.0086  0.1081  0.750753
moisture:soil      1 0.0860  0.0860  1.0855  0.327921
temp:moisture:soil 1 0.0051  0.0051  0.0648  0.805427
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
                 Df Sum Sq Mean Sq F value    Pr(>F)
temp              1 6.0503  6.0503 76.3427 2.303e-05 ***
moisture          1 0.9521  0.9521 12.0134  0.008492 **
temp:moisture     1 0.0013  0.0013  0.0162  0.901779
soil              1 0.4098  0.4098  5.1712  0.052559 .
temp:soil         1 0.0086  0.0086  0.1081  0.750753
moisture:soil     1 0.0860  0.0860  1.0855  0.327921
temp:moisture:soil 1 0.0051 0.0051  0.0648  0.805427
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
                 Df Sum Sq Mean Sq F value    Pr(>F)
temp              1 6.0503  6.0503 76.3427 2.303e-05 ***
moisture          1 0.9521  0.9521 12.0134  0.008492 **
temp:moisture     1 0.0013  0.0013  0.0162  0.901779
soil              1 0.4098  0.4098  5.1712  0.052559 .
temp:soil         1 0.0086  0.0086  0.1081  0.750753
moisture:soil     1 0.0860  0.0860  1.0855  0.327921
temp:moisture:soil 1 0.0051 0.0051  0.0648  0.805427
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
                       Estimate Std. Error t value  Pr(>|t|)
(Intercept)              4.2566    0.19906 21.3832 2.407e-08 ***
temp10                   1.2582    0.28152  4.4695  0.002085 **
temp30                   0.0000    0.00000
moistureH               -0.3591    0.28152 -1.2757  0.237854
moistureL                0.0000    0.00000
temp10:moistureH         0.0358    0.39813  0.0900  0.930514
temp10:moistureL         0.0000    0.00000
temp30:moistureH         0.0000    0.00000
temp30:moistureL         0.0000    0.00000
soilC                    0.4772    0.28152  1.6950  0.128514
soilP                    0.0000    0.00000
temp10:soilC            -0.0209    0.39813 -0.0524  0.959466
temp10:soilP             0.0000    0.00000
temp30:soilC             0.0000    0.00000
temp30:soilP             0.0000    0.00000
moistureH:soilC         -0.2216    0.39813 -0.5567  0.592977
moistureH:soilP          0.0000    0.00000
moistureL:soilC          0.0000    0.00000
moistureL:soilP          0.0000    0.00000
temp10:moistureH:soilC  -0.1434    0.56303 -0.2546  0.805427
temp10:moistureH:soilP   0.0000    0.00000
```

```
temp10:moistureL:soilC    0.0000     0.00000
temp10:moistureL:soilP    0.0000     0.00000
temp30:moistureH:soilC    0.0000     0.00000
temp30:moistureH:soilP    0.0000     0.00000
temp30:moistureL:soilC    0.0000     0.00000
temp30:moistureL:soilP    0.0000     0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.8   Chapter 11

10.8.1   p461

(183) MODEL

```
GLM(y ~ x1 + x2 + x1:x2 + x1:x3 + x2:x3, pest) # OK
```

```
$ANOVA
Response : y
                 Df  Sum Sq Mean Sq F value     Pr(>F)
MODEL            5 275.642  55.128  160.38 4.631e-07 ***
RESIDUALS        7   2.406   0.344
CORRECTED TOTAL 12 278.048
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
      Df  Sum Sq Mean Sq  F value     Pr(>F)
x1     1  83.402  83.402 242.6351 1.086e-06 ***
x2     1 161.734 161.734 470.5191 1.116e-07 ***
x1:x2  1   0.246   0.246   0.7169 0.4251627
x1:x3  1  15.663  15.663  45.5660 0.0002649 ***
x2:x3  1  14.596  14.596  42.4614 0.0003291 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
      Df  Sum Sq Mean Sq F value     Pr(>F)
x1     1 215.951 215.951 628.246 4.105e-08 ***
x2     1 175.256 175.256 509.855 8.458e-08 ***
x1:x2  1   0.025   0.025   0.072 0.7961658
x1:x3  1  14.539  14.539  42.298 0.0003330 ***
x2:x3  1  14.596  14.596  42.461 0.0003291 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
      Df  Sum Sq Mean Sq F value     Pr(>F)
x1     1 178.372 178.372 518.922 7.958e-08 ***
x2     1 145.518 145.518 423.341 1.608e-07 ***
x1:x2  1   0.025   0.025   0.072 0.7961658
x1:x3  1  14.539  14.539  42.298 0.0003330 ***
x2:x3  1  14.596  14.596  42.461 0.0003291 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error  t value   Pr(>|t|)
(Intercept)   65.375    0.52373 124.8256 5.587e-13 ***
x1           -16.482    0.72352 -22.7799 7.958e-08 ***
x2           -14.992    0.72864 -20.5752 1.608e-07 ***
x1:x2         -0.665    2.47759  -0.2684 0.7961658
x1:x3        -16.113    2.47759  -6.5037 0.0003330 ***
x2:x3        -16.919    2.59646  -6.5162 0.0003291 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.8.2   p469

(184) MODEL

```
GLM(y ~ x1 + x2 + x1:x2 + x1:x3 + x2:x3 + x1:x2:x3, polvdat) # OK
```

```
$ANOVA
Response : y
                Df  Sum Sq Mean Sq F value     Pr(>F)
MODEL            6 12.5313 2.08854  37.056 0.0005473 ***
RESIDUALS        5  0.2818 0.05636
CORRECTED TOTAL 11 12.8131
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type I`
         Df Sum Sq Mean Sq F value     Pr(>F)
x1        1 5.4668  5.4668 96.9942 0.0001839 ***
x2        1 0.3660  0.3660  6.4944 0.0513654 .
x1:x2     1 4.6897  4.6897 83.2068 0.0002652 ***
x1:x3     1 1.2450  1.2450 22.0887 0.0053378 **
x2:x3     1 0.4707  0.4707  8.3509 0.0341949 *
x1:x2:x3  1 0.2931  0.2931  5.2004 0.0714991 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
         Df Sum Sq Mean Sq F value    Pr(>F)
x1        1 0.0184  0.0184  0.3265 0.5924707
x2        1 0.2419  0.2419  4.2911 0.0930613 .
x1:x2     1 3.8824  3.8824 68.8834 0.0004147 ***
x1:x3     1 1.4383  1.4383 25.5196 0.0039276 **
x2:x3     1 0.4707  0.4707  8.3509 0.0341949 *
x1:x2:x3  1 0.2931  0.2931  5.2004 0.0714991 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
         Df  Sum Sq Mean Sq F value  Pr(>F)
x1        1 0.25744 0.25744  4.5677 0.08562 .
x2        1 0.12956 0.12956  2.2987 0.18992
x1:x2     1 0.65909 0.65909 11.6939 0.01885 *
x1:x3     1 0.26323 0.26323  4.6704 0.08307 .
x2:x3     1 0.12999 0.12999  2.3063 0.18931
x1:x2:x3  1 0.29310 0.29310  5.2004 0.07150 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)   1.2367     1.6150  0.7657  0.47840
x1            3.1892     1.4922  2.1372  0.08562 .
x2            2.2814     1.5047  1.5162  0.18992
x1:x2         6.9004     2.0179  3.4196  0.01885 *
x1:x3         8.9528     4.1427  2.1611  0.08307 .
x2:x3         5.3135     3.4988  1.5187  0.18931
x1:x2:x3     25.5460    11.2023  2.2804  0.07150 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.8.3 p482

(185) MODEL

```
REG(y ~ x1 + x2 + x3 + x1:x2 + x1:x3 + x2:x3 + x1:z1 + x2:z1 + x3:z1 +
        x1:x2:z1 + x1:x3:z1 + x2:x3:z1 + x1:z2 + x2:z2 + x3:z2 +
        x1:x2:z2 + x1:x3:z2 + x2:x3:z2 + x1:z1:z2 + x2:z1:z2 + x3:z1:z2 +
        x1:x2:z1:z2 + x1:x3:z1:z2 + x2:x3:z1:z2, MPV, NOINT=TRUE) # OK
```

```
        Estimate Std. Error t value  Pr(>|t|)
x1        346948     294197  1.1793 0.2631550
```

```
x2                8223        490 16.7869 3.467e-09 ***
x3                1656        459  3.6104 0.0040950 **
x1:x2          -414463     312262 -1.3273 0.2113017
x1:x3          -334747     311426 -1.0749 0.3054382
x2:x3            -6476       1199 -5.4032 0.0002156 ***
x1:z1           103044     328922  0.3133 0.7599297
x2:z1            -2241        548 -4.0924 0.0017824 **
x3:z1             823        513  1.6056 0.1366709
x1:x2:z1        -64013     349120 -0.1834 0.8578546
x1:x3:z1       -123730     348184 -0.3554 0.7290412
x2:x3:z1          4659       1340  3.4765 0.0051806 **
x1:z2           244320     328922  0.7428 0.4731733
x2:z2             886        548  1.6187 0.1338108
x3:z2              86        513  0.1670 0.8704301
x1:x2:z2       -266052     349120 -0.7621 0.4620497
x1:x3:z2       -253151     348184 -0.7271 0.4823761
x2:x3:z2         -1822       1340 -1.3593 0.2012686
x1:z1:z2        259038     328922  0.7875 0.4476062
x2:z1:z2          -137        548 -0.2500 0.8071853
x3:z1:z2           100        513  0.1955 0.8485983
x1:x2:z1:z2    -269527     349120 -0.7720 0.4563702
x1:x3:z1:z2    -269249     348184 -0.7733 0.4556454
x2:x3:z1:z2       -328       1340 -0.2448 0.8111141
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.9   Chapter 12

10.9.1   p513

(186) MODEL

```
GLM(ybar ~ A + B + C + D + E + F + G, tile) # OK
```

```
$ANOVA
Response : ybar
                Df   Sum Sq   Mean Sq F value Pr(>F)
MODEL           7 0.68737 0.098196
RESIDUALS       0 0.00000
CORRECTED TOTAL  7 0.68737


$`Type I`
  Df   Sum Sq Mean Sq F value Pr(>F)
A  1 0.04984 0.04984
B  1 0.01992 0.01992
C  1 0.51534 0.51534
```

```
D  1 0.01532 0.01532
E  1 0.05965 0.05965
F  1 0.00879 0.00879
G  1 0.01851 0.01851


$`Type II`
   Df  Sum Sq Mean Sq F value Pr(>F)
A  1 0.04984 0.04984
B  1 0.01992 0.01992
C  1 0.51534 0.51534
D  1 0.01532 0.01532
E  1 0.05965 0.05965
F  1 0.00879 0.00879
G  1 0.01851 0.01851


$`Type III`
   Df  Sum Sq Mean Sq F value Pr(>F)
A  1 0.04984 0.04984
B  1 0.01992 0.01992
C  1 0.51534 0.51534
D  1 0.01532 0.01532
E  1 0.05965 0.05965
F  1 0.00879 0.00879
G  1 0.01851 0.01851


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.74246
A            0.07893
B           -0.04990
C            0.25381
D           -0.04376
E            0.08635
F            0.03314
G           -0.04810
```

(187) MODEL

```
GLM(lns2 ~ A + B + C + D + E + F + G, tile) # OK


$ANOVA
Response : lns2
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL            7 12.305  1.7578
RESIDUALS        0  0.000
CORRECTED TOTAL  7 12.305
```

```
$`Type I`
  Df Sum Sq Mean Sq F value Pr(>F)
A  1 1.6436  1.6436
B  1 0.3109  0.3109
C  1 7.1858  7.1858
D  1 2.3199  2.3199
E  1 0.0248  0.0248
F  1 0.7379  0.7379
G  1 0.0820  0.0820


$`Type II`
  Df Sum Sq Mean Sq F value Pr(>F)
A  1 1.6436  1.6436
B  1 0.3109  0.3109
C  1 7.1858  7.1858
D  1 2.3199  2.3199
E  1 0.0248  0.0248
F  1 0.7379  0.7379
G  1 0.0820  0.0820


$`Type III`
  Df Sum Sq Mean Sq F value Pr(>F)
A  1 1.6436  1.6436
B  1 0.3109  0.3109
C  1 7.1858  7.1858
D  1 2.3199  2.3199
E  1 0.0248  0.0248
F  1 0.7379  0.7379
G  1 0.0820  0.0820


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -2.62342
A            0.45326
B           -0.19715
C            0.94775
D            0.53851
E            0.05564
F            0.30372
G           -0.10125
```

10.9.2   p521

(188) MODEL

```
strng = reshape(tile,
        direction = "long",
        varying = list(c("y1", "y2")),
        v.names = "y",
        idvar = c("A", "B", "C", "D", "E", "F", "G"),
        timevar = "H",
        times = c(-1, 1))
GLM(y ~ A/H + B/H + C/H + D/H + E/H + F/H + G/H, strng) # OK
```

$ANOVA
Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	14	1.65427	0.11816	0.1433	0.9807
RESIDUALS	1	0.82473	0.82473		
CORRECTED TOTAL	15	2.47901			

$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	0.09968	0.09968	0.1209	0.7870
A:H	1	0.04015	0.04015	0.0487	0.8618
B	1	0.03984	0.03984	0.0483	0.8623
H:B	1	0.00043	0.00043	0.0005	0.9854
C	1	1.03069	1.03069	1.2497	0.4646
H:C	1	0.15307	0.15307	0.1856	0.7410
D	1	0.03064	0.03064	0.0372	0.8788
H:D	1	0.04690	0.04690	0.0569	0.8510
E	1	0.11929	0.11929	0.1446	0.7686
H:E	1	0.01883	0.01883	0.0228	0.9045
F	1	0.01758	0.01758	0.0213	0.9077
H:F	1	0.01384	0.01384	0.0168	0.9180
G	1	0.03702	0.03702	0.0449	0.8671
H:G	1	0.00632	0.00632	0.0077	0.9444

$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	0.09968	0.09968	0.1209	0.7870
A:H	1	0.04015	0.04015	0.0487	0.8618
B	1	0.03984	0.03984	0.0483	0.8623
H:B	1	0.00043	0.00043	0.0005	0.9854
C	1	1.03069	1.03069	1.2497	0.4646
H:C	1	0.15307	0.15307	0.1856	0.7410
D	1	0.03064	0.03064	0.0372	0.8788
H:D	1	0.04690	0.04690	0.0569	0.8510
E	1	0.11929	0.11929	0.1446	0.7686
H:E	1	0.01883	0.01883	0.0228	0.9045
F	1	0.01758	0.01758	0.0213	0.9077
H:F	1	0.01384	0.01384	0.0168	0.9180

```
G     1 0.03702 0.03702   0.0449 0.8671
H:G   1 0.00632 0.00632   0.0077 0.9444
```

```
$`Type III`
    Df  Sum Sq Mean Sq F value Pr(>F)
A     1 0.09968 0.09968   0.1209 0.7870
A:H   1 0.04015 0.04015   0.0487 0.8618
B     1 0.03984 0.03984   0.0483 0.8623
H:B   1 0.00043 0.00043   0.0005 0.9854
C     1 1.03069 1.03069   1.2497 0.4646
H:C   1 0.15307 0.15307   0.1856 0.7410
D     1 0.03064 0.03064   0.0372 0.8788
H:D   1 0.04690 0.04690   0.0569 0.8510
E     1 0.11929 0.11929   0.1446 0.7686
H:E   1 0.01883 0.01883   0.0228 0.9045
F     1 0.01758 0.01758   0.0213 0.9077
H:F   1 0.01384 0.01384   0.0168 0.9180
G     1 0.03702 0.03702   0.0449 0.8671
H:G   1 0.00632 0.00632   0.0077 0.9444
```

```
$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.74246    0.22704  3.2702   0.1889
A            0.07893    0.22704  0.3477   0.7870
A:H          0.05009    0.22704  0.2206   0.8618
B           -0.04990    0.22704 -0.2198   0.8623
H:B          0.00520    0.22704  0.0229   0.9854
C            0.25381    0.22704  1.1179   0.4646
H:C          0.09781    0.22704  0.4308   0.7410
D           -0.04376    0.22704 -0.1928   0.8788
H:D          0.05414    0.22704  0.2385   0.8510
E            0.08635    0.22704  0.3803   0.7686
H:E          0.03431    0.22704  0.1511   0.9045
F            0.03314    0.22704  0.1460   0.9077
H:F          0.02941    0.22704  0.1296   0.9180
G           -0.04810    0.22704 -0.2119   0.8671
H:G          0.01987    0.22704  0.0875   0.9444
```

10.9.3   p525

(189) MODEL

```
prod2 = af(prodstd, 1:7)
GLM(Pof ~ A + B + C + D + E + F + G + A:G + A:E:F + B:E:G + C:E:G + C:E:G:F +
        D:E + D:F, prod2) # OK
```

$ANOVA

```
Response : Pof
              Df Sum Sq Mean Sq F value    Pr(>F)
MODEL          47 769.49 16.3721  5.1667 2.737e-05 ***
RESIDUALS      24  76.05  3.1688
CORRECTED TOTAL 71 845.54
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
        Df  Sum Sq Mean Sq F value    Pr(>F)
A        2  50.577  25.288  7.9806 0.0022023 **
B        2  13.384   6.692  2.1118 0.1429491
C        2  68.594  34.297 10.8234 0.0004463 ***
D        2  23.674  11.837  3.7355 0.0386914 *
E        1 275.733 275.733 87.0165 1.878e-09 ***
F        1 161.700 161.700 51.0296 2.204e-07 ***
G        1   1.051   1.051  0.3318 0.5699896
A:G      2  26.567  13.284  4.1921 0.0274494 *
A:E:F    7  28.404   4.058  1.2806 0.3013844
B:E:G    7  22.453   3.208  1.0123 0.4475160
C:E:G    6  35.546   5.924  1.8696 0.1277692
C:E:F:G 10  24.607   2.461  0.7766 0.6500534
D:E      2  21.745  10.873  3.4312 0.0489076 *
D:F      2  15.450   7.725  2.4379 0.1086730
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
        Df  Sum Sq Mean Sq F value    Pr(>F)
A        2  50.577  25.288  7.9806 0.0022023 **
B        2  13.384   6.692  2.1118 0.1429491
C        2  68.594  34.297 10.8234 0.0004463 ***
D        2  23.674  11.837  3.7355 0.0386914 *
E        1 275.733 275.733 87.0165 1.878e-09 ***
F        1 161.700 161.700 51.0296 2.204e-07 ***
G        1   1.051   1.051  0.3318 0.5699896
A:G      2  26.567  13.284  4.1921 0.0274494 *
A:E:F    6  24.623   4.104  1.2951 0.2970196
B:E:G    6  19.770   3.295  1.0398 0.4246194
C:E:G    6  35.546   5.924  1.8696 0.1277692
C:E:F:G 10  24.607   2.461  0.7766 0.6500534
D:E      2  21.745  10.873  3.4312 0.0489076 *
D:F      2  15.450   7.725  2.4379 0.1086730
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
CAUTION: Singularity Exists !
```

```
          Df  Sum Sq Mean Sq F value    Pr(>F)
A          2  50.577  25.288  7.9806 0.0022023 **
B          2  13.384   6.692  2.1118 0.1429491
C          2  68.594  34.297 10.8234 0.0004463 ***
D          2  23.674  11.837  3.7355 0.0386914 *
E          1 275.733 275.733 87.0165 1.878e-09 ***
F          1 161.700 161.700 51.0296 2.204e-07 ***
G          1   1.051   1.051  0.3318 0.5699896
A:G        2  26.567  13.284  4.1921 0.0274494 *
A:E:F      6  24.623   4.104  1.2951 0.2970196
B:E:G      6  19.770   3.295  1.0398 0.4246194
C:E:G      6  35.546   5.924  1.8696 0.1277692
C:E:F:G   10  24.607   2.461  0.7766 0.6500534
D:E        2  21.745  10.873  3.4312 0.0489076 *
D:F        2  15.450   7.725  2.4379 0.1086730
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
            Estimate Std. Error t value  Pr(>|t|)
(Intercept)  23.9833    1.45344 16.5010 1.332e-14 ***
A1           -4.1208    1.14905 -3.5863  0.001487 **
A2           -0.1792    1.14905 -0.1559  0.877395
A3            0.0000    0.00000
B1           -1.9500    1.02774 -1.8974  0.069875 .
B2           -0.3000    1.02774 -0.2919  0.772869
B3            0.0000    0.00000
C1            0.3000    1.45344  0.2064  0.838215
C2            2.6333    1.45344  1.8118  0.082552 .
C3            0.0000    0.00000
D1            1.6042    0.89005  1.8023  0.084067 .
D2            0.2958    0.89005  0.3324  0.742489
D3            0.0000    0.00000
E1           -4.2111    1.96797 -2.1398  0.042742 *
E2            0.0000    0.00000
F1           -3.1556    1.78010 -1.7727  0.088975 .
F2            0.0000    0.00000
G1            0.0889    1.78010  0.0499  0.960588
G2            0.0000    0.00000
A1:G1         2.9750    1.02774  2.8947  0.007959 **
A1:G2         0.0000    0.00000
A2:G1         1.4250    1.02774  1.3865  0.178329
A2:G2         0.0000    0.00000
A3:G1         0.0000    0.00000
A3:G2         0.0000    0.00000
A1:E1:F1      2.2667    2.78313  0.8144  0.423407
A1:E1:F2      2.6333    1.45344  1.8118  0.082552 .
A1:E2:F1      2.7833    1.45344  1.9150  0.067486 .
```

```
A1:E2:F2        0.0000    0.00000
A2:E1:F1        1.9667    2.78313   0.7066   0.486596
A2:E1:F2        1.3500    1.45344   0.9288   0.362226
A2:E2:F1       -0.1000    1.45344  -0.0688   0.945717
A2:E2:F2        0.0000    0.00000
A3:E1:F1        1.6333    2.37346   0.6882   0.497948
A3:E1:F2        0.0000    0.00000
A3:E2:F1        0.0000    0.00000
A3:E2:F2        0.0000    0.00000
B1:E1:G1       -1.6278    2.78313  -0.5849   0.564092
B1:E1:G2        2.3667    1.45344   1.6283   0.116516
B1:E2:G1        1.3000    1.45344   0.8944   0.379976
B1:E2:G2        0.0000    0.00000
B2:E1:G1       -3.5611    2.78313  -1.2795   0.212941
B2:E1:G2        1.3500    1.45344   0.9288   0.362226
B2:E2:G1        1.8333    1.45344   1.2614   0.219298
B2:E2:G2        0.0000    0.00000
B3:E1:G1       -3.1611    2.37346  -1.3319   0.195419
B3:E1:G2        0.0000    0.00000
B3:E2:G1        0.0000    0.00000
B3:E2:G2        0.0000    0.00000
C1:E1:G1       -1.9333    2.05548  -0.9406   0.356294
C1:E1:G2       -2.9000    2.05548  -1.4109   0.171117
C1:E2:G1       -3.4333    2.05548  -1.6703   0.107846
C1:E2:G2        0.0000    0.00000
C2:E1:G1       -2.4000    2.05548  -1.1676   0.254434
C2:E1:G2       -5.5667    2.05548  -2.7082   0.012273 *
C2:E2:G1       -4.3333    2.05548  -2.1082   0.045643 *
C2:E2:G2        0.0000    0.00000
C3:E1:G1        0.0000    0.00000
C3:E1:G2        0.0000    0.00000
C3:E2:G1        0.0000    0.00000
C3:E2:G2        0.0000    0.00000
C1:E1:F1:G1     1.3000    2.05548   0.6325   0.533069
C1:E1:F1:G2    -1.7333    2.05548  -0.8433   0.407402
C1:E1:F2:G1     0.0000    0.00000
C1:E1:F2:G2     0.0000    0.00000
C1:E2:F1:G1    -1.5000    2.05548  -0.7298   0.472602
C1:E2:F1:G2    -0.1000    2.05548  -0.0487   0.961600
C1:E2:F2:G1     0.0000    0.00000
C1:E2:F2:G2     0.0000    0.00000
C2:E1:F1:G1     0.5667    2.05548   0.2757   0.785149
C2:E1:F1:G2     2.6333    2.05548   1.2811   0.212390
C2:E1:F2:G1     0.0000    0.00000
C2:E1:F2:G2     0.0000    0.00000
C2:E2:F1:G1     0.9667    2.05548   0.4703   0.642395
C2:E2:F1:G2    -1.5667    2.05548  -0.7622   0.453373
C2:E2:F2:G1     0.0000    0.00000
```

```
C2:E2:F2:G2    0.0000     0.00000
C3:E1:F1:G1    1.8000     2.05548  0.8757  0.389869
C3:E1:F1:G2    0.0000     0.00000
C3:E1:F2:G1    0.0000     0.00000
C3:E1:F2:G2    0.0000     0.00000
C3:E2:F1:G1   -0.3333     2.05548 -0.1622  0.872531
C3:E2:F1:G2    0.0000     0.00000
C3:E2:F2:G1    0.0000     0.00000
C3:E2:F2:G2    0.0000     0.00000
D1:E1         -0.2583     1.02774 -0.2514  0.803675
D1:E2          0.0000     0.00000
D2:E1          2.1917     1.02774  2.1325  0.043397 *
D2:E2          0.0000     0.00000
D3:E1          0.0000     0.00000
D3:E2          0.0000     0.00000
D1:F1         -0.2417     1.02774 -0.2351  0.816092
D1:F2          0.0000     0.00000
D2:F1         -2.0750     1.02774 -2.0190  0.054793 .
D2:F2          0.0000     0.00000
D3:F1          0.0000     0.00000
D3:F2          0.0000     0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.9.4 p532

(190) MODEL

```
GLM(torque ~ A + B + C + D + E + A:B + A:C + A:D + A:E, Smotor) # OK
```

```
$ANOVA
Response : torque
                Df    Sum Sq     Mean Sq F value    Pr(>F)
MODEL           15 0.0112217 0.00074811   102.2 0.009731 **
RESIDUALS        2 0.0000146 0.00000732
CORRECTED TOTAL 17 0.0112363
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
    Df    Sum Sq   Mean Sq  F value    Pr(>F)
A    1 0.0039545 0.0039545 540.2187 0.001846 **
B    2 0.0003817 0.0001909  26.0732 0.036937 *
C    2 0.0057241 0.0028620 390.9837 0.002551 **
D    2 0.0000265 0.0000133   1.8104 0.355820
E    1 0.0000984 0.0000984  13.4406 0.067009 .
```

```
A:B  2 0.0010068 0.0005034   68.7668 0.014333 *
A:C  2 0.0000031 0.0000016    0.2134 0.824110
A:D  2 0.0000009 0.0000004    0.0599 0.943521
A:E  1 0.0000258 0.0000258    3.5198 0.201458
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type II`
    Df    Sum Sq   Mean Sq  F value    Pr(>F)
A    1 0.0039545 0.0039545 540.2187 0.001846 **
B    2 0.0003817 0.0001909  26.0732 0.036937 *
C    2 0.0032014 0.0016007 218.6753 0.004552 **
D    2 0.0000268 0.0000134   1.8319 0.353123
E    1 0.0000423 0.0000423   5.7744 0.138172
A:B  2 0.0010068 0.0005034  68.7668 0.014333 *
A:C  2 0.0000031 0.0000016   0.2134 0.824110
A:D  2 0.0000052 0.0000026   0.3536 0.738760
A:E  1 0.0000258 0.0000258   3.5198 0.201458
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$`Type III`
    Df    Sum Sq   Mean Sq  F value    Pr(>F)
A    1 0.0034241 0.0034241 467.7636 0.002131 **
B    2 0.0003817 0.0001909  26.0732 0.036937 *
C    2 0.0032014 0.0016007 218.6753 0.004552 **
D    2 0.0000268 0.0000134   1.8319 0.353123
E    1 0.0000423 0.0000423   5.7744 0.138172
A:B  2 0.0010068 0.0005034  68.7668 0.014333 *
A:C  2 0.0000031 0.0000016   0.2134 0.824110
A:D  2 0.0000052 0.0000026   0.3536 0.738760
A:E  1 0.0000258 0.0000258   3.5198 0.201458
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
             Estimate Std. Error  t value  Pr(>|t|)
(Intercept)  0.289577  0.0034044  85.0589 0.0001382 ***
A1          -0.032740  0.0042779  -7.6533 0.0166477 *
A2           0.000000  0.0000000
B1          -0.009206  0.0022091  -4.1673 0.0530418 .
B2           0.013405  0.0022091   6.0681 0.0260991 *
B3           0.000000  0.0000000
C1          -0.040333  0.0030249 -13.3336 0.0055778 **
C2          -0.023615  0.0030249  -7.8068 0.0160147 *
C3           0.000000  0.0000000
D1           0.004119  0.0030249   1.3617 0.3063965
D2           0.004196  0.0027056   1.5509 0.2610866
```

```
D3              0.000000  0.0000000
E1             -0.001008  0.0027056  -0.3726 0.7452485
E2              0.000000  0.0000000
A1:B1           0.029389  0.0031241   9.4070 0.0111124 *
A1:B2          -0.004253  0.0031241  -1.3612 0.3065165
A1:B3           0.000000  0.0000000
A2:B1           0.000000  0.0000000
A2:B2           0.000000  0.0000000
A2:B3           0.000000  0.0000000
A1:C1          -0.002699  0.0042779  -0.6310 0.5925465
A1:C2          -0.001250  0.0042779  -0.2923 0.7976178
A1:C3           0.000000  0.0000000
A2:C1           0.000000  0.0000000
A2:C2           0.000000  0.0000000
A2:C3           0.000000  0.0000000
A1:D1          -0.003579  0.0042779  -0.8367 0.4908121
A1:D2          -0.001141  0.0038262  -0.2983 0.7935889
A1:D3           0.000000  0.0000000
A2:D1           0.000000  0.0000000
A2:D2           0.000000  0.0000000
A2:D3           0.000000  0.0000000
A1:E1          -0.007178  0.0038262  -1.8761 0.2014578
A1:E2           0.000000  0.0000000
A2:E1           0.000000  0.0000000
A2:E2           0.000000  0.0000000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.9.5 p535

(191) MODEL

```
GLM(shrinkage ~ A + B + C + D + E + F + G + A:B + A:C + A:D + A:E + A:F + A:G +
               B:D, inject) # OK
```

```
$ANOVA
Response : shrinkage
                Df Sum Sq Mean Sq F value   Pr(>F)
MODEL           14 6659.4  475.67  129.08 1.97e-05 ***
RESIDUALS        5   18.4    3.68
CORRECTED TOTAL 19 6677.8
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
   Df Sum Sq Mean Sq   F value     Pr(>F)
```

```
A    1  770.1   770.1  208.9722 2.858e-05 ***
B    1 5076.6  5076.6 1377.6289 2.674e-07 ***
C    1    3.1     3.1    0.8311  0.403773
D    1    7.6     7.6    2.0522  0.211416
E    1    0.6     0.6    0.1526  0.712112
F    1    0.6     0.6    0.1526  0.712112
G    1   95.1    95.1   25.7972  0.003837 **
A:B  1  564.1   564.1  153.0699 6.112e-05 ***
A:C  1   10.6    10.6    2.8664  0.151230
A:D  1  115.6   115.6   31.3602  0.002508 **
A:E  1   14.1    14.1    3.8161  0.108185
A:F  1    1.6     1.6    0.4240  0.543677
A:G  1    0.1     0.1    0.0170  0.901459
B:D  1    0.1     0.1    0.0170  0.901459
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
    Df Sum Sq Mean Sq  F value    Pr(>F)
A    1  770.1   770.1  208.9722 2.858e-05 ***
B    1 5076.6  5076.6 1377.6289 2.674e-07 ***
C    1    3.1     3.1    0.8311  0.403773
D    1    7.6     7.6    2.0522  0.211416
E    1    0.6     0.6    0.1526  0.712112
F    1    0.6     0.6    0.1526  0.712112
G    1   95.1    95.1   25.7972  0.003837 **
A:B  1  564.1   564.1  153.0699 6.112e-05 ***
A:C  1   10.6    10.6    2.8664  0.151230
A:D  1  115.6   115.6   31.3602  0.002508 **
A:E  1   14.1    14.1    3.8161  0.108185
A:F  1    1.6     1.6    0.4240  0.543677
A:G  1    0.1     0.1    0.0170  0.901459
B:D  1    0.1     0.1    0.0170  0.901459
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
    Df Sum Sq Mean Sq  F value    Pr(>F)
A    1  770.1   770.1  208.9722 2.858e-05 ***
B    1 5076.6  5076.6 1377.6289 2.674e-07 ***
C    1    3.1     3.1    0.8311  0.403773
D    1    7.6     7.6    2.0522  0.211416
E    1    0.6     0.6    0.1526  0.712112
F    1    0.6     0.6    0.1526  0.712112
G    1   95.1    95.1   25.7972  0.003837 **
A:B  1  564.1   564.1  153.0699 6.112e-05 ***
A:C  1   10.6    10.6    2.8664  0.151230
A:D  1  115.6   115.6   31.3602  0.002508 **
```

```
A:E  1   14.1    14.1    3.8161  0.108185
A:F  1    1.6     1.6    0.4240  0.543677
A:G  1    0.1     0.1    0.0170  0.901459
B:D  1    0.1     0.1    0.0170  0.901459
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1


$Parameter
             Estimate Std. Error t value  Pr(>|t|)
(Intercept)  27.1000    0.42924 63.1343 1.887e-08 ***
A             6.9375    0.47991 14.4559 2.858e-05 ***
B            17.8125    0.47991 37.1164 2.674e-07 ***
C            -0.4375    0.47991 -0.9116  0.403773
D             0.6875    0.47991  1.4326  0.211416
E             0.1875    0.47991  0.3907  0.712112
F             0.1875    0.47991  0.3907  0.712112
G            -2.4375    0.47991 -5.0791  0.003837 **
A:B           5.9375    0.47991 12.3721 6.112e-05 ***
A:C          -0.8125    0.47991 -1.6930  0.151230
A:D          -2.6875    0.47991 -5.6000  0.002508 **
A:E          -0.9375    0.47991 -1.9535  0.108185
A:F           0.3125    0.47991  0.6512  0.543677
A:G          -0.0625    0.47991 -0.1302  0.901459
B:D          -0.0625    0.47991 -0.1302  0.901459
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.9.6 p539

(192) MODEL

```
eptax = cbind(eptaxr[1:16,], y2=eptaxr[17:32,9], y3=eptaxr[33:48,9],
              y5=eptaxr[49:64,9])
eptax$ybar = (eptax$y + eptax$y2 + eptax$y3 + eptax$y5)/4
GLM(ybar ~ A + B + C + D + E + F + G + H + A:B + A:C + A:D + A:E + A:F + A:G +
           A:H, eptax) # OK
```

```
$ANOVA
Response : ybar
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL           15 2.8452 0.18968
RESIDUALS        0 0.0000
CORRECTED TOTAL 15 2.8452

$`Type I`
    Df  Sum Sq Mean Sq F value Pr(>F)
```

```
A     1 0.02686 0.02686
B     1 0.00042 0.00042
C     1 0.06306 0.06306
D     1 2.49443 2.49443
E     1 0.00304 0.00304
F     1 0.03209 0.03209
G     1 0.02954 0.02954
H     1 0.12879 0.12879
A:B   1 0.00047 0.00047
A:C   1 0.03218 0.03218
A:D   1 0.01185 0.01185
A:E   1 0.00380 0.00380
A:F   1 0.01674 0.01674
A:G   1 0.00186 0.00186
A:H   1 0.00012 0.00012


$`Type II`
      Df  Sum Sq Mean Sq F value Pr(>F)
A     1 0.02686 0.02686
B     1 0.00042 0.00042
C     1 0.06306 0.06306
D     1 2.49443 2.49443
E     1 0.00304 0.00304
F     1 0.03209 0.03209
G     1 0.02954 0.02954
H     1 0.12879 0.12879
A:B   1 0.00047 0.00047
A:C   1 0.03218 0.03218
A:D   1 0.01185 0.01185
A:E   1 0.00380 0.00380
A:F   1 0.01674 0.01674
A:G   1 0.00186 0.00186
A:H   1 0.00012 0.00012


$`Type III`
      Df  Sum Sq Mean Sq F value Pr(>F)
A     1 0.02686 0.02686
B     1 0.00042 0.00042
C     1 0.06306 0.06306
D     1 2.49443 2.49443
E     1 0.00304 0.00304
F     1 0.03209 0.03209
G     1 0.02954 0.02954
H     1 0.12879 0.12879
A:B   1 0.00047 0.00047
A:C   1 0.03218 0.03218
A:D   1 0.01185 0.01185
A:E   1 0.00380 0.00380
```

```
A:F  1 0.01674 0.01674
A:G  1 0.00186 0.00186
A:H  1 0.00012 0.00012


$Parameter
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  14.3612
A            -0.0410
B             0.0051
C            -0.0628
D            -0.3948
E            -0.0138
F             0.0448
G            -0.0430
H             0.0897
A:B           0.0054
A:C          -0.0448
A:D           0.0272
A:E           0.0154
A:F           0.0323
A:G          -0.0108
A:H           0.0028
```

11 Searle - Linear Models 2e

Reference

- Searle SR, Gruber MHJ. Linear Models 2e, Kindle Edition. John Wiley & Sons Inc. 2016.

11.1 7.2 (p390, 59%)

(193) MODEL

```
weight = c(8,13,9,12,7,11,6,12,12,14,9,7,14,16,10,14,11,13)
treatment = c("ta","ta","ta","ta","ta","ta","tb","tb","tb","tb","tc","tc","tc",
              "tc","tc","tc","tc","tc")
variety = c("va","va","va","vc","vd","vd","va","va","vb","vb","vb","vb","vc",
            "vc","vd","vd","vd","vd")
d1 = data.frame(weight, treatment, variety)
GLM(weight ~ treatment*variety, d1)
```

```
$ANOVA
Response : weight
                Df Sum Sq Mean Sq F value Pr(>F)
MODEL            7    82   11.714  2.0918   0.14
RESIDUALS       10    56    5.600
CORRECTED TOTAL 17   138

$`Type I`
                 Df Sum Sq Mean Sq F value  Pr(>F)
treatment         2 10.500   5.250  0.9375 0.42348
variety           3 36.786  12.262  2.1896 0.15232
treatment:variety 2 34.714  17.357  3.0995 0.08965 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
                 Df Sum Sq Mean Sq F value  Pr(>F)
treatment         2  9.486  4.7429  0.8469 0.45731
variety           3 36.786 12.2619  2.1896 0.15232
treatment:variety 2 34.714 17.3571  3.0995 0.08965 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
                 Df Sum Sq Mean Sq F value  Pr(>F)
treatment         2 12.471  6.2353  1.1134 0.36595
variety           3 34.872 11.6240  2.0757 0.16719
treatment:variety 2 34.714 17.3571  3.0995 0.08965 .
```

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
                         Estimate Std. Error t value  Pr(>|t|)
(Intercept)                    12     1.1832 10.1419 1.397e-06 ***
treatmentta                    -3     2.0494 -1.4639   0.17395
treatmenttb                     5     2.3664  2.1129   0.06075 .
treatmenttc                     0     0.0000
varietyva                      -8     3.1305 -2.5555   0.02859 *
varietyvb                      -4     2.0494 -1.9518   0.07951 .
varietyvc                       3     2.0494  1.4639   0.17395
varietyvd                       0     0.0000
treatmentta:varietyva           9     3.8035  2.3662   0.03953 *
treatmentta:varietyvb           0     0.0000
treatmentta:varietyvc           0     3.5496  0.0000   1.00000
treatmentta:varietyvd           0     0.0000
treatmenttb:varietyva           0     0.0000
treatmenttb:varietyvb           0     0.0000
treatmenttb:varietyvc           0     0.0000
treatmenttb:varietyvd           0     0.0000
treatmenttc:varietyva           0     0.0000
treatmenttc:varietyvb           0     0.0000
treatmenttc:varietyvc           0     0.0000
treatmenttc:varietyvd           0     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
options(contrasts = c("contr.sum", "contr.poly"))
Anova(lm(weight ~ treatment*variety, d1), type=3, singular.ok=TRUE) # NOT OK
```

```
Note: model has aliased coefficients
      sums of squares computed by model comparison


Anova Table (Type III tests)

Response: weight
                  Sum Sq Df F values  Pr(>F)
treatment          0.000  0
variety            0.000  0
treatment:variety 34.714  2   3.0995 0.08965 .
Residuals         56.000 10
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

11.2 7.2 (p393, 60%)

(194) MODEL

```
percent = c(31,33,44,36,38,26,37,59,42,42,34,42,28,39,36,32,38,42,36,22,42,46,
            26,37,43)
refinery = c(rep("g",9),rep("n",8),rep("s",8))
process = as.factor(c(1,1,1,1,1,1,2,2,2,1,1,1,1,2,2,2,2,1,1,1,2,2,2,2,2))
source0 = c("t","t","t","t","o","m","t","t","o","m","i","i","i","t","o","m","m",
            "t","o","i","o","o","m","i","i")
d2 = data.frame(percent, refinery, process, source=source0)
GLM(percent ~ refinery*source, d2)
```

```
$ANOVA
Response : percent
                Df  Sum Sq Mean Sq F value Pr(>F)
MODEL           10  442.56  44.256  0.6361 0.7616
RESIDUALS       14  974.00  69.571
CORRECTED TOTAL 24 1416.56

$`Type I`
                Df  Sum Sq Mean Sq F value Pr(>F)
refinery         2  20.963  10.481  0.1507 0.8615
source           3 266.124  88.708  1.2751 0.3212
refinery:source  5 155.474  31.095  0.4469 0.8086

$`Type II`
                Df  Sum Sq Mean Sq F value Pr(>F)
refinery         2  25.535  12.767  0.1835 0.8343
source           3 266.124  88.708  1.2751 0.3212
refinery:source  5 155.474  31.095  0.4469 0.8086

$`Type III`
                Df  Sum Sq Mean Sq F value Pr(>F)
refinery         2  10.766   5.383  0.0774 0.9259
source           3 282.633  94.211  1.3542 0.2972
refinery:source  5 155.474  31.095  0.4469 0.8086

$Parameter
                Estimate Std. Error t value  Pr(>|t|)
(Intercept)       42.000     8.3409  5.0354 0.0001822 ***
refineryg         -2.000     9.0093 -0.2220 0.8275243
refineryn         -3.000    11.7959 -0.2543 0.8029412
refinerys          0.000     0.0000
sourcei           -8.000     9.6313 -0.8306 0.4201255
sourcem          -16.000    11.7959 -1.3564 0.1964425
sourceo           -0.667     9.6313 -0.0692 0.9457944
```

```
sourcet               0.000      0.0000
refineryg:sourcei     0.000      0.0000
refineryg:sourcem     2.000     14.8428   0.1347 0.8947314
refineryg:sourceo     0.667     11.7959   0.0565 0.9557287
refineryg:sourcet     0.000      0.0000
refineryn:sourcei     3.667     13.6207   0.2692 0.7917042
refineryn:sourcem    14.333     15.2284   0.9412 0.3625491
refineryn:sourceo    -2.333     15.2284  -0.1532 0.8804095
refineryn:sourcet     0.000      0.0000
refinerys:sourcei     0.000      0.0000
refinerys:sourcem     0.000      0.0000
refinerys:sourceo     0.000      0.0000
refinerys:sourcet     0.000      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(percent ~ refinery*source, d2), type=3, singular.ok=TRUE) # NOT OK
```

```
Note: model has aliased coefficients
      sums of squares computed by model comparison


Anova Table (Type III tests)

Response: percent
                Sum Sq Df F values Pr(>F)
refinery          2.52  1   0.0362 0.8518
source          268.19  2   1.9275 0.1822
refinery:source 155.47  5   0.4469 0.8086
Residuals       974.00 14
```

12   Test Summary

Package	Version	Total Count	Identical to SAS	Different from SAS
sasLM	0.2.0	194	194 (100%)	0 (0%)
car	3.0.7	194	< 174 (90%)	>= 20 (10%)

All of the results in sasLM 0.2.0 were identical, while type III SSs of Model (83) and (84) were different from those of SAS in sasLM 0.1.2 package.

Slight differences in the last digits between type II and type III SS (when they should be same) are resulted from the round-to-even number way of R rounding function.

If you are uncertain about the equivalence of the 'sasLM' to 'SAS,' you can use 'SAS University Edition' for free.

If you find any discrepancies, please mail to the author, Kyun-Seop Bae k@acr.kr.

13 Sesssion Information

```
R version 3.6.3 (2020-02-29)
Platform: x86_64-w64-mingw32/x64 (64-bit)
Running under: Windows 10 x64 (build 17763)

Matrix products: default

locale:
[1] LC_COLLATE=Korean_Korea.949  LC_CTYPE=Korean_Korea.949
[3] LC_MONETARY=Korean_Korea.949 LC_NUMERIC=C
[5] LC_TIME=Korean_Korea.949

attached base packages:
[1] stats     graphics  grDevices utils     datasets  methods   base

other attached packages:
[1] daewr_1.2-3   car_3.0-7     carData_3.0-3 sasLM_0.2.0   rmarkdown_2.1

loaded via a namespace (and not attached):
 [1] zoo_1.8-7          xfun_0.13         partitions_1.9-22
 [4] haven_2.2.0        lattice_0.20-41   colorspace_1.4-1
 [7] vctrs_0.2.4        htmltools_0.4.0   yaml_2.2.1
[10] gmp_0.5-13.6       rlang_0.4.5       pillar_1.4.3
[13] foreign_0.8-76     glue_1.4.0        readxl_1.3.1
[16] lifecycle_0.2.0    stringr_1.4.0     combinat_0.0-8
[19] cellranger_1.1.0   DoE.base_1.1-5    zip_2.0.4
[22] evaluate_0.14      knitr_1.28        rio_0.5.16
[25] forcats_0.5.0      lmtest_0.9-37     curl_4.3
[28] numbers_0.7-5      fansi_0.4.1       vcd_1.4-7
[31] conf.design_2.0.0  Rcpp_1.0.4.6      polynom_1.4-0
[34] scatterplot3d_0.3-41 abind_1.4-5     FrF2_2.1-1
[37] hms_0.5.3          digest_0.6.25     stringi_1.4.6
[40] openxlsx_4.1.4     grid_3.6.3        cli_2.0.2
[43] tools_3.6.3        magrittr_1.5      tibble_3.0.0
[46] crayon_1.3.4       pkgconfig_2.0.3   MASS_7.3-51.5
[49] ellipsis_0.3.0     data.table_1.12.8 assertthat_0.2.1
[52] sfsmisc_1.1-6      igraph_1.2.5      compiler_3.6.3
```