Validation of ‘sasLM’ Package

Kyun-Seop Bae MD PhD

2021-04-21 20:36:31

Contents

1 Tested Version and Books used for the Validation

1.1 Packages Used

- 'sasLM' version: 0.5.3
- 'SAS' version: 9.4 Licensed and University Edition
- 'car' version: 3.0.10
- R version: R version 4.0.5 (2021-03-31)

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.

```
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)        5         0    0.85635 15  5.8387 3.261e-05 ***
Ration1           -1         0    1.35401 15 -0.7385    0.4716
Ration2            1         0    1.13284 15  0.8827    0.3913
Ration3            0         0    0.00000 15
---
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   5.2697         0    0.83682 14  6.2973 1.964e-05 ***
Sire1        -0.4607         0    1.34009 14 -0.3438    0.7361
Sire2         1.7416         0    1.18344 14  1.4716    0.1632
Sire3         0.0000         0    0.00000 14
Ration1      -1.6180         0    1.04129 14 -1.5538    0.1425
Ration2       0.0000         0    0.00000 14
---
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)     5.4000         0    0.65912 12  8.1927 2.944e-06 ***
Sire1          -2.9000         0    1.23311 12 -2.3518   0.03659 *
Sire2           2.9333         0    1.07634 12  2.7253   0.01843 *
Sire3           0.0000         0    0.00000 12
Ration1        -2.4000         0    1.61452 12 -1.4865   0.16294
Ration2         0.0000         0    0.00000 12
Sire1:Ration1   5.4000         0    2.18607 12  2.4702   0.02948 *
Sire1:Ration2   0.0000         0    0.00000 12
Sire2:Ration1  -1.3333         0    1.94041 12 -0.6871   0.50506
Sire2:Ration2   0.0000         0    0.00000 12
Sire3:Ration1   0.0000         0    0.00000 12
Sire3:Ration2   0.0000         0    0.00000 12
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

2.3 p101

(4) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)  2.95068         0    0.51867 48  5.6889 7.461e-07 ***
Line1        0.08058         0    0.14600 48  0.5519  0.583562
Line2        0.25898         0    0.13801 48  1.8765  0.066672 .
Line3        0.00000         0    0.00000 48
Sire1        0.07353         0    0.13054 48  0.5633  0.575872
Sire2       -0.12448         0    0.13720 48 -0.9072  0.368814
```

```
Sire3        0.00000         0    0.00000 48
Sire4       -0.23837         0    0.12753 48 -1.8692  0.067704 .
Sire5        0.00000         0    0.00000 48
Sire6        0.10359         0    0.13013 48  0.7960  0.429928
Sire7       -0.02129         0    0.12129 48 -0.1756  0.861372
Sire8       -0.33135         0    0.12662 48 -2.6168  0.011834 *
Sire9        0.00000         0    0.00000 48
Dam3         0.36999         0    0.11530 48  3.2090  0.002375 **
Dam4         0.27711         0    0.10444 48  2.6533  0.010777 *
Dam5         0.00000         0    0.00000 48
Line1:Dam3  -0.44415         0    0.19686 48 -2.2562  0.028649 *
Line1:Dam4  -0.30365         0    0.16070 48 -1.8896  0.064862 .
Line1:Dam5   0.00000         0    0.00000 48
Line2:Dam3  -0.26743         0    0.19635 48 -1.3620  0.179554
Line2:Dam4  -0.35600         0    0.17540 48 -2.0297  0.047954 *
Line2:Dam5   0.00000         0    0.00000 48
Line3:Dam3   0.00000         0    0.00000 48
Line3:Dam4   0.00000         0    0.00000 48
Line3:Dam5   0.00000         0    0.00000 48
Age         -0.00815         1    0.00312 48 -2.6164  0.011845 *
Weight       0.00197         1    0.00087 48  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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)  2.35075         0    0.09704 50 24.2246 < 2.2e-16 ***
Sire1        0.20311         0    0.14084 50  1.4422  0.155488
Sire2       -0.06287         0    0.13258 50 -0.4742  0.637414
Sire3        0.16834         0    0.15153 50  1.1109  0.271905
Sire4        0.18107         0    0.14313 50  1.2650  0.211718
Sire5        0.31743         0    0.14313 50  2.2178  0.031143 *
Sire6       -0.01585         0    0.13038 50 -0.1215  0.903749
Sire7       -0.11844         0    0.12299 50 -0.9630  0.340164
Sire8       -0.42213         0    0.13012 50 -3.2442  0.002102 **
Sire9        0.00000         0    0.00000 50
Dam3         0.33813         0    0.12177 50  2.7768  0.007706 **
Dam4         0.27529         0    0.11078 50  2.4849  0.016348 *
Dam5         0.00000         0    0.00000 50
Dam3:Line1  -0.45707         0    0.20303 50 -2.2512  0.028796 *
Dam3:Line2  -0.38540         0    0.20378 50 -1.8913  0.064384 .
Dam3:Line3   0.00000         0    0.00000 50
Dam4:Line1  -0.38180         0    0.16807 50 -2.2717  0.027443 *
Dam4:Line2  -0.43029         0    0.18374 50 -2.3418  0.023215 *
Dam4:Line3   0.00000         0    0.00000 50
Dam5:Line1   0.00000         0    0.00000 50
Dam5:Line2   0.00000         0    0.00000 50
Dam5:Line3   0.00000         0    0.00000 50
---
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  70.30  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  70.30  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  70.30  1.6739

$Parameter
                              Estimate Estimable Std. Error Df t value Pr(>|t|)
(Intercept)                        6.8         0             0
Day1                               2.0         0             0
Day2                               1.3         0             0
Day3                               0.6         0             0
Day4                               1.2         0             0
Day5                               2.7         0             0
```

Day6	2.4	0	0
Day7	6.0	0	0
Day8	2.4	0	0
Day9	4.5	0	0
Day10	2.5	0	0
Day11	-2.8	0	0
Day12	2.9	0	0
Day13	-2.2	0	0
Day14	-4.7	0	0
Day15	2.9	0	0
Day16	3.2	0	0
Day17	3.4	0	0
Day18	2.4	0	0
Day19	4.0	0	0
Day20	2.6	0	0
Day21	3.5	0	0
Day22	3.5	0	0
Day23	1.5	0	0
Day24	4.8	0	0
Day25	2.6	0	0
Day26	4.5	0	0
Day27	4.6	0	0
Day28	2.8	0	0
Day29	-4.6	0	0
Day30	-0.2	0	0
Day31	4.7	0	0
Day32	2.3	0	0
Day33	-2.2	0	0
Day34	1.1	0	0
Day35	2.2	0	0
Day36	1.3	0	0
Day37	2.6	0	0
Day38	4.1	0	0
Day39	2.2	0	0
Day40	1.0	0	0
Day41	2.5	0	0
Day42	0.0	0	0
Day1:Machine1	-2.2	0	0
Day1:Machine2	0.0	0	0
Day2:Machine1	0.1	0	0
Day2:Machine2	0.0	0	0
Day3:Machine1	0.6	0	0
Day3:Machine2	0.0	0	0
Day4:Machine1	-1.5	0	0
Day4:Machine2	0.0	0	0
Day5:Machine1	-7.2	0	0
Day5:Machine2	0.0	0	0
Day6:Machine1	-5.2	0	0

Day6:Machine2	0.0	0	0
Day7:Machine1	-1.1	0	0
Day7:Machine2	0.0	0	0
Day8:Machine1	-2.4	0	0
Day8:Machine2	0.0	0	0
Day9:Machine1	-0.8	0	0
Day9:Machine2	0.0	0	0
Day10:Machine1	1.0	0	0
Day10:Machine2	0.0	0	0
Day11:Machine1	6.0	0	0
Day11:Machine2	0.0	0	0
Day12:Machine1	-0.9	0	0
Day12:Machine2	0.0	0	0
Day13:Machine1	2.1	0	0
Day13:Machine2	0.0	0	0
Day14:Machine1	6.8	0	0
Day14:Machine2	0.0	0	0
Day15:Machine1	0.2	0	0
Day15:Machine2	0.0	0	0
Day16:Machine1	-1.8	0	0
Day16:Machine2	0.0	0	0
Day17:Machine1	-2.7	0	0
Day17:Machine2	0.0	0	0
Day18:Machine1	-2.6	0	0
Day18:Machine2	0.0	0	0
Day19:Machine1	-7.7	0	0
Day19:Machine2	0.0	0	0
Day20:Machine1	-2.2	0	0
Day20:Machine2	0.0	0	0
Day21:Machine1	0.4	0	0
Day21:Machine2	0.0	0	0
Day22:Machine1	-1.9	0	0
Day22:Machine2	0.0	0	0
Day23:Machine1	-0.7	0	0
Day23:Machine2	0.0	0	0
Day24:Machine1	1.0	0	0
Day24:Machine2	0.0	0	0
Day25:Machine1	0.2	0	0
Day25:Machine2	0.0	0	0
Day26:Machine1	1.3	0	0
Day26:Machine2	0.0	0	0
Day27:Machine1	-0.6	0	0
Day27:Machine2	0.0	0	0
Day28:Machine1	-4.5	0	0
Day28:Machine2	0.0	0	0
Day29:Machine1	4.4	0	0
Day29:Machine2	0.0	0	0
Day30:Machine1	2.0	0	0

Day30:Machine2	0.0	0	0
Day31:Machine1	1.0	0	0
Day31:Machine2	0.0	0	0
Day32:Machine1	1.3	0	0
Day32:Machine2	0.0	0	0
Day33:Machine1	6.0	0	0
Day33:Machine2	0.0	0	0
Day34:Machine1	-0.7	0	0
Day34:Machine2	0.0	0	0
Day35:Machine1	-1.2	0	0
Day35:Machine2	0.0	0	0
Day36:Machine1	-3.7	0	0
Day36:Machine2	0.0	0	0
Day37:Machine1	-0.7	0	0
Day37:Machine2	0.0	0	0
Day38:Machine1	0.3	0	0
Day38:Machine2	0.0	0	0
Day39:Machine1	1.3	0	0
Day39:Machine2	0.0	0	0
Day40:Machine1	-0.8	0	0
Day40:Machine2	0.0	0	0
Day41:Machine1	-1.6	0	0
Day41:Machine2	0.0	0	0
Day42:Machine1	0.8	0	0
Day42:Machine2	0.0	0	0
Day1:Machine1:Analyst1	0.0	0	0
Day1:Machine1:Analyst2	0.0	0	0
Day1:Machine2:Analyst1	0.0	0	0
Day1:Machine2:Analyst2		0	
Day2:Machine1:Analyst1	1.4	0	0
Day2:Machine1:Analyst2	0.0	0	0
Day2:Machine2:Analyst1	0.0	0	0
Day2:Machine2:Analyst2		0	
Day3:Machine1:Analyst1	-1.3	0	0
Day3:Machine1:Analyst2	0.0	0	0
Day3:Machine2:Analyst1	0.0	0	0
Day3:Machine2:Analyst2		0	
Day4:Machine1:Analyst1	0.7	0	0
Day4:Machine1:Analyst2	0.0	0	0
Day4:Machine2:Analyst1	0.0	0	0
Day4:Machine2:Analyst2		0	
Day5:Machine1:Analyst1	4.8	0	0
Day5:Machine1:Analyst2	0.0	0	0
Day5:Machine2:Analyst1	0.0	0	0
Day5:Machine2:Analyst2		0	
Day6:Machine1:Analyst1	5.0	0	0
Day6:Machine1:Analyst2	0.0	0	0
Day6:Machine2:Analyst1	0.0	0	0

Day6:Machine2:Analyst2		0	
Day7:Machine1:Analyst1	-1.9	0	0
Day7:Machine1:Analyst2	0.0	0	0
Day7:Machine2:Analyst1	0.0	0	0
Day7:Machine2:Analyst2		0	
Day8:Machine1:Analyst1	1.2	0	0
Day8:Machine1:Analyst2	0.0	0	0
Day8:Machine2:Analyst1	0.0	0	0
Day8:Machine2:Analyst2		0	
Day9:Machine1:Analyst1	0.4	0	0
Day9:Machine1:Analyst2	0.0	0	0
Day9:Machine2:Analyst1	0.0	0	0
Day9:Machine2:Analyst2		0	
Day10:Machine1:Analyst1	0.3	0	0
Day10:Machine1:Analyst2	0.0	0	0
Day10:Machine2:Analyst1	0.0	0	0
Day10:Machine2:Analyst2		0	
Day11:Machine1:Analyst1	-1.6	0	0
Day11:Machine1:Analyst2	0.0	0	0
Day11:Machine2:Analyst1	0.0	0	0
Day11:Machine2:Analyst2		0	
Day12:Machine1:Analyst1	1.8	0	0
Day12:Machine1:Analyst2	0.0	0	0
Day12:Machine2:Analyst1	0.0	0	0
Day12:Machine2:Analyst2		0	
Day13:Machine1:Analyst1	0.5	0	0
Day13:Machine1:Analyst2	0.0	0	0
Day13:Machine2:Analyst1	0.0	0	0
Day13:Machine2:Analyst2		0	
Day14:Machine1:Analyst1	-0.9	0	0
Day14:Machine1:Analyst2	0.0	0	0
Day14:Machine2:Analyst1	0.0	0	0
Day14:Machine2:Analyst2		0	
Day15:Machine1:Analyst1	-1.2	0	0
Day15:Machine1:Analyst2	0.0	0	0
Day15:Machine2:Analyst1	0.0	0	0
Day15:Machine2:Analyst2		0	
Day16:Machine1:Analyst1	0.5	0	0
Day16:Machine1:Analyst2	0.0	0	0
Day16:Machine2:Analyst1	0.0	0	0
Day16:Machine2:Analyst2		0	
Day17:Machine1:Analyst1	-0.7	0	0
Day17:Machine1:Analyst2	0.0	0	0
Day17:Machine2:Analyst1	0.0	0	0
Day17:Machine2:Analyst2		0	
Day18:Machine1:Analyst1	0.0	0	0
Day18:Machine1:Analyst2	0.0	0	0
Day18:Machine2:Analyst1	0.0	0	0

Day18:Machine2:Analyst2		0	
Day19:Machine1:Analyst1	4.0	0	0
Day19:Machine1:Analyst2	0.0	0	0
Day19:Machine2:Analyst1	0.0	0	0
Day19:Machine2:Analyst2		0	
Day20:Machine1:Analyst1	2.8	0	0
Day20:Machine1:Analyst2	0.0	0	0
Day20:Machine2:Analyst1	0.0	0	0
Day20:Machine2:Analyst2		0	
Day21:Machine1:Analyst1	-1.2	0	0
Day21:Machine1:Analyst2	0.0	0	0
Day21:Machine2:Analyst1	0.0	0	0
Day21:Machine2:Analyst2		0	
Day22:Machine1:Analyst1	-0.7	0	0
Day22:Machine1:Analyst2	0.0	0	0
Day22:Machine2:Analyst1	0.0	0	0
Day22:Machine2:Analyst2		0	
Day23:Machine1:Analyst1	1.2	0	0
Day23:Machine1:Analyst2	0.0	0	0
Day23:Machine2:Analyst1	0.0	0	0
Day23:Machine2:Analyst2		0	
Day24:Machine1:Analyst1	-0.4	0	0
Day24:Machine1:Analyst2	0.0	0	0
Day24:Machine2:Analyst1	0.0	0	0
Day24:Machine2:Analyst2		0	
Day25:Machine1:Analyst1	0.8	0	0
Day25:Machine1:Analyst2	0.0	0	0
Day25:Machine2:Analyst1	0.0	0	0
Day25:Machine2:Analyst2		0	
Day26:Machine1:Analyst1	-2.0	0	0
Day26:Machine1:Analyst2	0.0	0	0
Day26:Machine2:Analyst1	0.0	0	0
Day26:Machine2:Analyst2		0	
Day27:Machine1:Analyst1	-0.2	0	0
Day27:Machine1:Analyst2	0.0	0	0
Day27:Machine2:Analyst1	0.0	0	0
Day27:Machine2:Analyst2		0	
Day28:Machine1:Analyst1	2.2	0	0
Day28:Machine1:Analyst2	0.0	0	0
Day28:Machine2:Analyst1	0.0	0	0
Day28:Machine2:Analyst2		0	
Day29:Machine1:Analyst1	0.4	0	0
Day29:Machine1:Analyst2	0.0	0	0
Day29:Machine2:Analyst1	0.0	0	0
Day29:Machine2:Analyst2		0	
Day30:Machine1:Analyst1	-1.6	0	0
Day30:Machine1:Analyst2	0.0	0	0
Day30:Machine2:Analyst1	0.0	0	0

Day30:Machine2:Analyst2		0	
Day31:Machine1:Analyst1	-3.3	0	0
Day31:Machine1:Analyst2	0.0	0	0
Day31:Machine2:Analyst1	0.0	0	0
Day31:Machine2:Analyst2		0	
Day32:Machine1:Analyst1	1.3	0	0
Day32:Machine1:Analyst2	0.0	0	0
Day32:Machine2:Analyst1	0.0	0	0
Day32:Machine2:Analyst2		0	
Day33:Machine1:Analyst1	0.0	0	0
Day33:Machine1:Analyst2	0.0	0	0
Day33:Machine2:Analyst1	0.0	0	0
Day33:Machine2:Analyst2		0	
Day34:Machine1:Analyst1	3.2	0	0
Day34:Machine1:Analyst2	0.0	0	0
Day34:Machine2:Analyst1	0.0	0	0
Day34:Machine2:Analyst2		0	
Day35:Machine1:Analyst1	0.6	0	0
Day35:Machine1:Analyst2	0.0	0	0
Day35:Machine2:Analyst1	0.0	0	0
Day35:Machine2:Analyst2		0	
Day36:Machine1:Analyst1	2.4	0	0
Day36:Machine1:Analyst2	0.0	0	0
Day36:Machine2:Analyst1	0.0	0	0
Day36:Machine2:Analyst2		0	
Day37:Machine1:Analyst1	1.4	0	0
Day37:Machine1:Analyst2	0.0	0	0
Day37:Machine2:Analyst1	0.0	0	0
Day37:Machine2:Analyst2		0	
Day38:Machine1:Analyst1	-0.2	0	0
Day38:Machine1:Analyst2	0.0	0	0
Day38:Machine2:Analyst1	0.0	0	0
Day38:Machine2:Analyst2		0	
Day39:Machine1:Analyst1	-0.3	0	0
Day39:Machine1:Analyst2	0.0	0	0
Day39:Machine2:Analyst1	0.0	0	0
Day39:Machine2:Analyst2		0	
Day40:Machine1:Analyst1	1.0	0	0
Day40:Machine1:Analyst2	0.0	0	0
Day40:Machine2:Analyst1	0.0	0	0
Day40:Machine2:Analyst2		0	
Day41:Machine1:Analyst1	-0.5	0	0
Day41:Machine1:Analyst2	0.0	0	0
Day41:Machine2:Analyst1	0.0	0	0
Day41:Machine2:Analyst2		0	
Day42:Machine1:Analyst1	1.2	0	0
Day42:Machine1:Analyst2	0.0	0	0
Day42:Machine2:Analyst1	0.0	0	0

Day42:Machine2:Analyst2		0	
Day1:Machine1:Analyst1:Test1	-0.5	0	0
Day1:Machine1:Analyst1:Test2	0.0	0	0
Day1:Machine1:Analyst2:Test1	0.0	0	0
Day1:Machine1:Analyst2:Test2		0	
Day1:Machine2:Analyst1:Test1	0.0	0	0
Day1:Machine2:Analyst1:Test2		0	
Day1:Machine2:Analyst2:Test1		0	
Day1:Machine2:Analyst2:Test2		0	
Day2:Machine1:Analyst1:Test1	-1.1	0	0
Day2:Machine1:Analyst1:Test2	0.0	0	0
Day2:Machine1:Analyst2:Test1	0.0	0	0
Day2:Machine1:Analyst2:Test2		0	
Day2:Machine2:Analyst1:Test1	0.0	0	0
Day2:Machine2:Analyst1:Test2		0	
Day2:Machine2:Analyst2:Test1		0	
Day2:Machine2:Analyst2:Test2		0	
Day3:Machine1:Analyst1:Test1	1.9	0	0
Day3:Machine1:Analyst1:Test2	0.0	0	0
Day3:Machine1:Analyst2:Test1	0.0	0	0
Day3:Machine1:Analyst2:Test2		0	
Day3:Machine2:Analyst1:Test1	0.0	0	0
Day3:Machine2:Analyst1:Test2		0	
Day3:Machine2:Analyst2:Test1		0	
Day3:Machine2:Analyst2:Test2		0	
Day4:Machine1:Analyst1:Test1	2.1	0	0
Day4:Machine1:Analyst1:Test2	0.0	0	0
Day4:Machine1:Analyst2:Test1	0.0	0	0
Day4:Machine1:Analyst2:Test2		0	
Day4:Machine2:Analyst1:Test1	0.0	0	0
Day4:Machine2:Analyst1:Test2		0	
Day4:Machine2:Analyst2:Test1		0	
Day4:Machine2:Analyst2:Test2		0	
Day5:Machine1:Analyst1:Test1	1.0	0	0
Day5:Machine1:Analyst1:Test2	0.0	0	0
Day5:Machine1:Analyst2:Test1	0.0	0	0
Day5:Machine1:Analyst2:Test2		0	
Day5:Machine2:Analyst1:Test1	0.0	0	0
Day5:Machine2:Analyst1:Test2		0	
Day5:Machine2:Analyst2:Test1		0	
Day5:Machine2:Analyst2:Test2		0	
Day6:Machine1:Analyst1:Test1	-0.5	0	0
Day6:Machine1:Analyst1:Test2	0.0	0	0
Day6:Machine1:Analyst2:Test1	0.0	0	0
Day6:Machine1:Analyst2:Test2		0	
Day6:Machine2:Analyst1:Test1	0.0	0	0
Day6:Machine2:Analyst1:Test2		0	
Day6:Machine2:Analyst2:Test1		0	

Day6:Machine2:Analyst2:Test2		0	
Day7:Machine1:Analyst1:Test1	0.0	0	0
Day7:Machine1:Analyst1:Test2	0.0	0	0
Day7:Machine1:Analyst2:Test1	0.0	0	0
Day7:Machine1:Analyst2:Test2		0	
Day7:Machine2:Analyst1:Test1	0.0	0	0
Day7:Machine2:Analyst1:Test2		0	
Day7:Machine2:Analyst2:Test1		0	
Day7:Machine2:Analyst2:Test2		0	
Day8:Machine1:Analyst1:Test1	1.0	0	0
Day8:Machine1:Analyst1:Test2	0.0	0	0
Day8:Machine1:Analyst2:Test1	0.0	0	0
Day8:Machine1:Analyst2:Test2		0	
Day8:Machine2:Analyst1:Test1	0.0	0	0
Day8:Machine2:Analyst1:Test2		0	
Day8:Machine2:Analyst2:Test1		0	
Day8:Machine2:Analyst2:Test2		0	
Day9:Machine1:Analyst1:Test1	0.1	0	0
Day9:Machine1:Analyst1:Test2	0.0	0	0
Day9:Machine1:Analyst2:Test1	0.0	0	0
Day9:Machine1:Analyst2:Test2		0	
Day9:Machine2:Analyst1:Test1	0.0	0	0
Day9:Machine2:Analyst1:Test2		0	
Day9:Machine2:Analyst2:Test1		0	
Day9:Machine2:Analyst2:Test2		0	
Day10:Machine1:Analyst1:Test1	-0.9	0	0
Day10:Machine1:Analyst1:Test2	0.0	0	0
Day10:Machine1:Analyst2:Test1	0.0	0	0
Day10:Machine1:Analyst2:Test2		0	
Day10:Machine2:Analyst1:Test1	0.0	0	0
Day10:Machine2:Analyst1:Test2		0	
Day10:Machine2:Analyst2:Test1		0	
Day10:Machine2:Analyst2:Test2		0	
Day11:Machine1:Analyst1:Test1	2.1	0	0
Day11:Machine1:Analyst1:Test2	0.0	0	0
Day11:Machine1:Analyst2:Test1	0.0	0	0
Day11:Machine1:Analyst2:Test2		0	
Day11:Machine2:Analyst1:Test1	0.0	0	0
Day11:Machine2:Analyst1:Test2		0	
Day11:Machine2:Analyst2:Test1		0	
Day11:Machine2:Analyst2:Test2		0	
Day12:Machine1:Analyst1:Test1	-2.3	0	0
Day12:Machine1:Analyst1:Test2	0.0	0	0
Day12:Machine1:Analyst2:Test1	0.0	0	0
Day12:Machine1:Analyst2:Test2		0	
Day12:Machine2:Analyst1:Test1	0.0	0	0
Day12:Machine2:Analyst1:Test2		0	
Day12:Machine2:Analyst2:Test1		0	

Day12:Machine2:Analyst2:Test2		0	
Day13:Machine1:Analyst1:Test1	1.2	0	0
Day13:Machine1:Analyst1:Test2	0.0	0	0
Day13:Machine1:Analyst2:Test1	0.0	0	0
Day13:Machine1:Analyst2:Test2		0	
Day13:Machine2:Analyst1:Test1	0.0	0	0
Day13:Machine2:Analyst1:Test2		0	
Day13:Machine2:Analyst2:Test1		0	
Day13:Machine2:Analyst2:Test2		0	
Day14:Machine1:Analyst1:Test1	2.2	0	0
Day14:Machine1:Analyst1:Test2	0.0	0	0
Day14:Machine1:Analyst2:Test1	0.0	0	0
Day14:Machine1:Analyst2:Test2		0	
Day14:Machine2:Analyst1:Test1	0.0	0	0
Day14:Machine2:Analyst1:Test2		0	
Day14:Machine2:Analyst2:Test1		0	
Day14:Machine2:Analyst2:Test2		0	
Day15:Machine1:Analyst1:Test1	0.6	0	0
Day15:Machine1:Analyst1:Test2	0.0	0	0
Day15:Machine1:Analyst2:Test1	0.0	0	0
Day15:Machine1:Analyst2:Test2		0	
Day15:Machine2:Analyst1:Test1	0.0	0	0
Day15:Machine2:Analyst1:Test2		0	
Day15:Machine2:Analyst2:Test1		0	
Day15:Machine2:Analyst2:Test2		0	
Day16:Machine1:Analyst1:Test1	-1.6	0	0
Day16:Machine1:Analyst1:Test2	0.0	0	0
Day16:Machine1:Analyst2:Test1	0.0	0	0
Day16:Machine1:Analyst2:Test2		0	
Day16:Machine2:Analyst1:Test1	0.0	0	0
Day16:Machine2:Analyst1:Test2		0	
Day16:Machine2:Analyst2:Test1		0	
Day16:Machine2:Analyst2:Test2		0	
Day17:Machine1:Analyst1:Test1	-1.0	0	0
Day17:Machine1:Analyst1:Test2	0.0	0	0
Day17:Machine1:Analyst2:Test1	0.0	0	0
Day17:Machine1:Analyst2:Test2		0	
Day17:Machine2:Analyst1:Test1	0.0	0	0
Day17:Machine2:Analyst1:Test2		0	
Day17:Machine2:Analyst2:Test1		0	
Day17:Machine2:Analyst2:Test2		0	
Day18:Machine1:Analyst1:Test1	2.3	0	0
Day18:Machine1:Analyst1:Test2	0.0	0	0
Day18:Machine1:Analyst2:Test1	0.0	0	0
Day18:Machine1:Analyst2:Test2		0	
Day18:Machine2:Analyst1:Test1	0.0	0	0
Day18:Machine2:Analyst1:Test2		0	
Day18:Machine2:Analyst2:Test1		0	

Day18:Machine2:Analyst2:Test2		0	
Day19:Machine1:Analyst1:Test1	4.4	0	0
Day19:Machine1:Analyst1:Test2	0.0	0	0
Day19:Machine1:Analyst2:Test1	0.0	0	0
Day19:Machine1:Analyst2:Test2		0	
Day19:Machine2:Analyst1:Test1	0.0	0	0
Day19:Machine2:Analyst1:Test2		0	
Day19:Machine2:Analyst2:Test1		0	
Day19:Machine2:Analyst2:Test2		0	
Day20:Machine1:Analyst1:Test1	0.3	0	0
Day20:Machine1:Analyst1:Test2	0.0	0	0
Day20:Machine1:Analyst2:Test1	0.0	0	0
Day20:Machine1:Analyst2:Test2		0	
Day20:Machine2:Analyst1:Test1	0.0	0	0
Day20:Machine2:Analyst1:Test2		0	
Day20:Machine2:Analyst2:Test1		0	
Day20:Machine2:Analyst2:Test2		0	
Day21:Machine1:Analyst1:Test1	-0.4	0	0
Day21:Machine1:Analyst1:Test2	0.0	0	0
Day21:Machine1:Analyst2:Test1	0.0	0	0
Day21:Machine1:Analyst2:Test2		0	
Day21:Machine2:Analyst1:Test1	0.0	0	0
Day21:Machine2:Analyst1:Test2		0	
Day21:Machine2:Analyst2:Test1		0	
Day21:Machine2:Analyst2:Test2		0	
Day22:Machine1:Analyst1:Test1	-2.0	0	0
Day22:Machine1:Analyst1:Test2	0.0	0	0
Day22:Machine1:Analyst2:Test1	0.0	0	0
Day22:Machine1:Analyst2:Test2		0	
Day22:Machine2:Analyst1:Test1	0.0	0	0
Day22:Machine2:Analyst1:Test2		0	
Day22:Machine2:Analyst2:Test1		0	
Day22:Machine2:Analyst2:Test2		0	
Day23:Machine1:Analyst1:Test1	-0.3	0	0
Day23:Machine1:Analyst1:Test2	0.0	0	0
Day23:Machine1:Analyst2:Test1	0.0	0	0
Day23:Machine1:Analyst2:Test2		0	
Day23:Machine2:Analyst1:Test1	0.0	0	0
Day23:Machine2:Analyst1:Test2		0	
Day23:Machine2:Analyst2:Test1		0	
Day23:Machine2:Analyst2:Test2		0	
Day24:Machine1:Analyst1:Test1	-2.6	0	0
Day24:Machine1:Analyst1:Test2	0.0	0	0
Day24:Machine1:Analyst2:Test1	0.0	0	0
Day24:Machine1:Analyst2:Test2		0	
Day24:Machine2:Analyst1:Test1	0.0	0	0
Day24:Machine2:Analyst1:Test2		0	
Day24:Machine2:Analyst2:Test1		0	

Day24:Machine2:Analyst2:Test2		0	
Day25:Machine1:Analyst1:Test1	-1.0	0	0
Day25:Machine1:Analyst1:Test2	0.0	0	0
Day25:Machine1:Analyst2:Test1	0.0	0	0
Day25:Machine1:Analyst2:Test2		0	
Day25:Machine2:Analyst1:Test1	0.0	0	0
Day25:Machine2:Analyst1:Test2		0	
Day25:Machine2:Analyst2:Test1		0	
Day25:Machine2:Analyst2:Test2		0	
Day26:Machine1:Analyst1:Test1	-0.3	0	0
Day26:Machine1:Analyst1:Test2	0.0	0	0
Day26:Machine1:Analyst2:Test1	0.0	0	0
Day26:Machine1:Analyst2:Test2		0	
Day26:Machine2:Analyst1:Test1	0.0	0	0
Day26:Machine2:Analyst1:Test2		0	
Day26:Machine2:Analyst2:Test1		0	
Day26:Machine2:Analyst2:Test2		0	
Day27:Machine1:Analyst1:Test1	-3.6	0	0
Day27:Machine1:Analyst1:Test2	0.0	0	0
Day27:Machine1:Analyst2:Test1	0.0	0	0
Day27:Machine1:Analyst2:Test2		0	
Day27:Machine2:Analyst1:Test1	0.0	0	0
Day27:Machine2:Analyst1:Test2		0	
Day27:Machine2:Analyst2:Test1		0	
Day27:Machine2:Analyst2:Test2		0	
Day28:Machine1:Analyst1:Test1	4.2	0	0
Day28:Machine1:Analyst1:Test2	0.0	0	0
Day28:Machine1:Analyst2:Test1	0.0	0	0
Day28:Machine1:Analyst2:Test2		0	
Day28:Machine2:Analyst1:Test1	0.0	0	0
Day28:Machine2:Analyst1:Test2		0	
Day28:Machine2:Analyst2:Test1		0	
Day28:Machine2:Analyst2:Test2		0	
Day29:Machine1:Analyst1:Test1	-1.0	0	0
Day29:Machine1:Analyst1:Test2	0.0	0	0
Day29:Machine1:Analyst2:Test1	0.0	0	0
Day29:Machine1:Analyst2:Test2		0	
Day29:Machine2:Analyst1:Test1	0.0	0	0
Day29:Machine2:Analyst1:Test2		0	
Day29:Machine2:Analyst2:Test1		0	
Day29:Machine2:Analyst2:Test2		0	
Day30:Machine1:Analyst1:Test1	1.0	0	0
Day30:Machine1:Analyst1:Test2	0.0	0	0
Day30:Machine1:Analyst2:Test1	0.0	0	0
Day30:Machine1:Analyst2:Test2		0	
Day30:Machine2:Analyst1:Test1	0.0	0	0
Day30:Machine2:Analyst1:Test2		0	
Day30:Machine2:Analyst2:Test1		0	

Day30:Machine2:Analyst2:Test2		0	
Day31:Machine1:Analyst1:Test1	4.2	0	0
Day31:Machine1:Analyst1:Test2	0.0	0	0
Day31:Machine1:Analyst2:Test1	0.0	0	0
Day31:Machine1:Analyst2:Test2		0	
Day31:Machine2:Analyst1:Test1	0.0	0	0
Day31:Machine2:Analyst1:Test2		0	
Day31:Machine2:Analyst2:Test1		0	
Day31:Machine2:Analyst2:Test2		0	
Day32:Machine1:Analyst1:Test1	0.4	0	0
Day32:Machine1:Analyst1:Test2	0.0	0	0
Day32:Machine1:Analyst2:Test1	0.0	0	0
Day32:Machine1:Analyst2:Test2		0	
Day32:Machine2:Analyst1:Test1	0.0	0	0
Day32:Machine2:Analyst1:Test2		0	
Day32:Machine2:Analyst2:Test1		0	
Day32:Machine2:Analyst2:Test2		0	
Day33:Machine1:Analyst1:Test1	3.6	0	0
Day33:Machine1:Analyst1:Test2	0.0	0	0
Day33:Machine1:Analyst2:Test1	0.0	0	0
Day33:Machine1:Analyst2:Test2		0	
Day33:Machine2:Analyst1:Test1	0.0	0	0
Day33:Machine2:Analyst1:Test2		0	
Day33:Machine2:Analyst2:Test1		0	
Day33:Machine2:Analyst2:Test2		0	
Day34:Machine1:Analyst1:Test1	-0.4	0	0
Day34:Machine1:Analyst1:Test2	0.0	0	0
Day34:Machine1:Analyst2:Test1	0.0	0	0
Day34:Machine1:Analyst2:Test2		0	
Day34:Machine2:Analyst1:Test1	0.0	0	0
Day34:Machine2:Analyst1:Test2		0	
Day34:Machine2:Analyst2:Test1		0	
Day34:Machine2:Analyst2:Test2		0	
Day35:Machine1:Analyst1:Test1	-1.9	0	0
Day35:Machine1:Analyst1:Test2	0.0	0	0
Day35:Machine1:Analyst2:Test1	0.0	0	0
Day35:Machine1:Analyst2:Test2		0	
Day35:Machine2:Analyst1:Test1	0.0	0	0
Day35:Machine2:Analyst1:Test2		0	
Day35:Machine2:Analyst2:Test1		0	
Day35:Machine2:Analyst2:Test2		0	
Day36:Machine1:Analyst1:Test1	-0.3	0	0
Day36:Machine1:Analyst1:Test2	0.0	0	0
Day36:Machine1:Analyst2:Test1	0.0	0	0
Day36:Machine1:Analyst2:Test2		0	
Day36:Machine2:Analyst1:Test1	0.0	0	0
Day36:Machine2:Analyst1:Test2		0	
Day36:Machine2:Analyst2:Test1		0	

Day36:Machine2:Analyst2:Test2		0	
Day37:Machine1:Analyst1:Test1	-0.9	0	0
Day37:Machine1:Analyst1:Test2	0.0	0	0
Day37:Machine1:Analyst2:Test1	0.0	0	0
Day37:Machine1:Analyst2:Test2		0	
Day37:Machine2:Analyst1:Test1	0.0	0	0
Day37:Machine2:Analyst1:Test2		0	
Day37:Machine2:Analyst2:Test1		0	
Day37:Machine2:Analyst2:Test2		0	
Day38:Machine1:Analyst1:Test1	0.0	0	0
Day38:Machine1:Analyst1:Test2	0.0	0	0
Day38:Machine1:Analyst2:Test1	0.0	0	0
Day38:Machine1:Analyst2:Test2		0	
Day38:Machine2:Analyst1:Test1	0.0	0	0
Day38:Machine2:Analyst1:Test2		0	
Day38:Machine2:Analyst2:Test1		0	
Day38:Machine2:Analyst2:Test2		0	
Day39:Machine1:Analyst1:Test1	-1.4	0	0
Day39:Machine1:Analyst1:Test2	0.0	0	0
Day39:Machine1:Analyst2:Test1	0.0	0	0
Day39:Machine1:Analyst2:Test2		0	
Day39:Machine2:Analyst1:Test1	0.0	0	0
Day39:Machine2:Analyst1:Test2		0	
Day39:Machine2:Analyst2:Test1		0	
Day39:Machine2:Analyst2:Test2		0	
Day40:Machine1:Analyst1:Test1	0.9	0	0
Day40:Machine1:Analyst1:Test2	0.0	0	0
Day40:Machine1:Analyst2:Test1	0.0	0	0
Day40:Machine1:Analyst2:Test2		0	
Day40:Machine2:Analyst1:Test1	0.0	0	0
Day40:Machine2:Analyst1:Test2		0	
Day40:Machine2:Analyst2:Test1		0	
Day40:Machine2:Analyst2:Test2		0	
Day41:Machine1:Analyst1:Test1	-0.6	0	0
Day41:Machine1:Analyst1:Test2	0.0	0	0
Day41:Machine1:Analyst2:Test1	0.0	0	0
Day41:Machine1:Analyst2:Test2		0	
Day41:Machine2:Analyst1:Test1	0.0	0	0
Day41:Machine2:Analyst1:Test2		0	
Day41:Machine2:Analyst2:Test1		0	
Day41:Machine2:Analyst2:Test2		0	
Day42:Machine1:Analyst1:Test1	-0.4	0	0
Day42:Machine1:Analyst1:Test2	0.0	0	0
Day42:Machine1:Analyst2:Test1	0.0	0	0
Day42:Machine1:Analyst2:Test2		0	
Day42:Machine2:Analyst1:Test1	0.0	0	0
Day42:Machine2:Analyst1:Test2		0	
Day42:Machine2:Analyst2:Test1		0	

```
Day42:Machine2:Analyst2:Test2                    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 Estimable Std. Error Df t value Pr(>|t|)
```

```
(Intercept)    6.610         0     0.8987  4  7.3551  0.00182 **
A1            -1.465         0     1.2710  4 -1.1527  0.31324
A2             0.000         0     0.0000  4
B1             0.050         0     1.2710  4  0.0393  0.97050
B2             0.000         0     0.0000  4
A1:B1         -1.720         0     1.7974  4 -0.9569  0.39279
A1:B2          0.000         0     0.0000  4
A2:B1          0.000         0     0.0000  4
A2:B2          0.000         0     0.0000  4
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(8) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
```

```
(Intercept)    6.610         0     0.8987  4  7.3551  0.00182 **
A1            -1.465         0     1.2710  4 -1.1527  0.31324
A2             0.000         0     0.0000  4
A1:B1         -1.670         0     1.2710  4 -1.3140  0.25914
A1:B2          0.000         0     0.0000  4
A2:B1          0.050         0     1.2710  4  0.0393  0.97050
A2:B2          0.000         0     0.0000  4
B1             0.000         0     0.0000  4
B2             0.000         0     0.0000  4
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(9) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
```

```
(Intercept)    6.610         0     0.8987  4  7.3551  0.00182 **
B1             0.050         0     1.2710  4  0.0393  0.97050
B2             0.000         0     0.0000  4
A1            -1.465         0     1.2710  4 -1.1527  0.31324
A2             0.000         0     0.0000  4
B1:A1         -1.720         0     1.7974  4 -0.9569  0.39279
B1:A2          0.000         0     0.0000  4
B2:A1          0.000         0     0.0000  4
B2:A2          0.000         0     0.0000  4
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(10) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)    6.610         0     0.8987  4  7.3551  0.00182 **
B1             0.050         0     1.2710  4  0.0393  0.97050
```

```
B2              0.000         0     0.0000  4
B1:A1          -3.185         0     1.2710  4 -2.5060  0.06634 .
B1:A2           0.000         0     0.0000  4
B2:A1          -1.465         0     1.2710  4 -1.1527  0.31324
B2:A2           0.000         0     0.0000  4
A1              0.000         0     0.0000  4
A2              0.000         0     0.0000  4
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(11) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)    6.610         0     0.8987  4  7.3551  0.00182 **
A1:B1         -3.135         0     1.2710  4 -2.4667  0.06920 .
A1:B2         -1.465         0     1.2710  4 -1.1527  0.31324
A2:B1          0.050         0     1.2710  4  0.0393  0.97050
```

```
A2:B2          0.000         0     0.0000  4
A1             0.000         0     0.0000  4
A2             0.000         0     0.0000  4
B1             0.000         0     0.0000  4
B2             0.000         0     0.0000  4
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(12) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)    6.610         0     0.8987  4  7.3551  0.00182 **
A1:B1         -3.135         0     1.2710  4 -2.4667  0.06920 .
A1:B2         -1.465         0     1.2710  4 -1.1527  0.31324
A2:B1          0.050         0     1.2710  4  0.0393  0.97050
A2:B2          0.000         0     0.0000  4
A1             0.000         0     0.0000  4
```

```
A2              0.000         0     0.0000  4
B1              0.000         0     0.0000  4
B2              0.000         0     0.0000  4
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

4.2 Type II SS

4.2.1 p14

(13) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)    6.840         0     1.4555  3  4.6994  0.01823 *
A1            -1.695         0     1.7826  3 -0.9508  0.41183
A2             0.000         0     0.0000  3
B1            -0.180         0     1.7826  3 -0.1010  0.92594
B2             0.000         0     0.0000  3
A1:B1         -1.490         0     2.3014  3 -0.6474  0.56347
A1:B2          0.000         0     0.0000  3
A2:B1          0.000         0     0.0000  3
```

```
A2:B2          0.000         0     0.0000  3
---
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

$`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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   10.290         0    1.11945  7  9.1920 3.718e-05 ***
A1            -2.305         0    0.91403  7 -2.5218   0.03971 *
A2             0.000         0    0.00000  7
B1            -6.450         0    2.23891  7 -2.8809   0.02362 *
B2            -4.080         0    1.29263  7 -3.1563   0.01601 *
```

```
B3            -1.610         0    0.91403  7 -1.7614   0.12155
B4             0.000         0    0.00000  7
C1             1.065         0    2.23891  7  0.4757   0.64879
C2             1.760         0    1.29263  7  1.3616   0.21553
C3             0.000         0    0.00000  7
C4             0.000         0    0.00000  7
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

4.3 Type III SS

4.3.1 p27

(15) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   16.270         0    0.84809  6 19.1844 1.298e-06 ***
A1            -8.870         0    0.97929  6 -9.0576 0.0001015 ***
A2            -4.915         0    0.69246  6 -7.0979 0.0003927 ***
A3             0.000         0    0.00000  6
B1            -4.900         0    0.69246  6 -7.0762 0.0003993 ***
B2            -1.875         0    0.97929  6 -1.9147 0.1040334
B3             0.000         0    0.00000  6
A1:B1                        0
A1:B2         -0.460         0    1.19937  6 -0.3835 0.7145464
A1:B3          0.000         0    0.00000  6
A2:B1          0.000         0    0.00000  6
A2:B2                        0
A2:B3          0.000         0    0.00000  6
A3:B1          0.000         0    0.00000  6
A3:B2          0.000         0    0.00000  6
A3:B3                        0
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

4.3.2 p33

(16) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)     9.53         0             0
A1             -1.63         0             0
A2              0.02         0             0
A3              0.00         0             0
B1             -4.76         0             0
B2              0.00         0             0
B3              0.00         0             0
A1:B1          -0.18         0             0
A1:B2           0.00         0             0
A1:B3                        0
A2:B1           0.00         0             0
A2:B2           0.00         0             0
A2:B3                        0
A3:B1                        0
A3:B2                        0
A3:B3           0.00         0             0
```

```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 Df t value  Pr(>|t|)
(Intercept)   7.1965     4.3751 17  1.6449    0.1184
CATTLE        4.5640     0.5925 17  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 Df t value  Pr(>|t|)
(Intercept)   2.2884     3.3874 14  0.6756 0.5103160
CATTLE        3.2155     0.4222 14  7.6170 2.413e-06 ***
CALVES        1.6131     0.8517 14  1.8941 0.0790616 .
HOGS          0.8148     0.4707 14  1.7310 0.1054198
```

```
SHEEP         0.8026     0.1898 14  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 Df t value  Pr(>|t|)
(Intercept)   1.0709     3.5272 15  0.3036 0.7655951
CATTLE        3.3665     0.4397 15  7.6568 1.471e-06 ***
CALVES        2.1046     0.8547 15  2.4624 0.0263909 *
SHEEP         0.9267     0.1871 15  4.9528 0.0001735 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(20) MODEL

```r
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 Df t value  Pr(>|t|)
(Intercept)   1.0709     3.5272 15  0.3036 0.7655951
CATTLE        3.3665     0.4397 15  7.6568 1.471e-06 ***
CALVES        2.1046     0.8547 15  2.4624 0.0263909 *
SHEEP         0.9267     0.1871 15  4.9528 0.0001735 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(21) MODEL

```r
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 Df t value  Pr(>|t|)
(Intercept)       2.2721     3.1899 15  0.7123    0.4872
CATTLE            3.2162     0.4066 15  7.9106 9.887e-07 ***
CALVES            1.6194     0.7739 15  2.0926    0.0538 .
I(HOGS + SHEEP)   0.8052     0.1402 15  5.7437 3.883e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(22) MODEL

```r
REG(COST ~ CATTLE + CALVES + I(HOGS + SHEEP) - 1, p12)
```

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

```
CATTLE            3.3000    0.38314 16  8.6131 2.100e-07 ***
CALVES            1.9672    0.59108 16  3.3281  0.004259 **
I(HOGS + SHEEP)   0.8068    0.13800 16  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

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)    220.150         0     31.760 28  6.9316 1.553e-07 ***
bloc1          152.600         0     36.674 28  4.1610 0.0002725 ***
bloc2          249.600         0     36.674 28  6.8060 2.155e-07 ***
bloc3           83.400         0     36.674 28  2.2741 0.0308206 *
bloc4         -112.000         0     36.674 28 -3.0540 0.0049132 **
bloc5          115.400         0     36.674 28  3.1467 0.0038956 **
bloc6          101.800         0     36.674 28  2.7758 0.0097029 **
bloc7           45.000         0     36.674 28  1.2270 0.2300251
bloc8            0.000         0      0.000 28
irrigbasin      -9.250         0     28.993 28 -0.3190 0.7520625
irrigflood     -70.000         0     28.993 28 -2.4144 0.0225461 *
irrigspray     -75.875         0     28.993 28 -2.6170 0.0141421 *
irrigsprnkler   -7.625         0     28.993 28 -0.2630 0.7944806
irrigtrickle     0.000         0      0.000 28
---
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   210.25         0     6.1872  6 33.9815 4.325e-08 ***
run1            9.25         0     5.5340  6  1.6715 0.1456579
run2            7.00         0     5.5340  6  1.2649 0.2528101
run3           21.75         0     5.5340  6  3.9303 0.0077104 **
run4            0.00         0     0.0000  6
pos1            8.50         0     5.5340  6  1.5360 0.1754542
pos2           26.25         0     5.5340  6  4.7434 0.0031802 **
pos3            8.25         0     5.5340  6  1.4908 0.1866076
pos4            0.00         0     0.0000  6
matA           35.25         0     5.5340  6  6.3697 0.0007032 ***
matB          -10.50         0     5.5340  6 -1.8974 0.1065582
matC           11.25         0     5.5340  6  2.0329 0.0883093 .
matD            0.00         0     0.0000  6
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)    41.75         0     1.3693  6 30.4899 8.261e-08 ***
run1            0.50         0     1.2247  6  0.4082  0.697261
run2            1.25         0     1.2247  6  1.0206  0.346810
run3            3.75         0     1.2247  6  3.0619  0.022172 *
run4            0.00         0     0.0000  6
pos1            2.75         0     1.2247  6  2.2454  0.065859 .
pos2            5.00         0     1.2247  6  4.0825  0.006484 **
pos3            0.75         0     1.2247  6  0.6124  0.562764
pos4            0.00         0     0.0000  6
matA            6.75         0     1.2247  6  5.5114  0.001499 **
matB           -2.00         0     1.2247  6 -1.6330  0.153590
matC            2.75         0     1.2247  6  2.2454  0.065859 .
matD            0.00         0     0.0000  6
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.2.3 p75

(25) MODEL

```r
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"),
```

```r
        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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)       12.5500         0     1.8097 75  6.9348  1.23e-09 ***
methoda            9.7833         0     2.5593 75  3.8226 0.0002707 ***
methodb            6.6667         0     2.5593 75  2.6049 0.0110772 *
methodc            0.0000         0     0.0000 75
variety1           5.8667         0     2.5593 75  2.2923 0.0246955 *
variety2           7.3667         0     2.5593 75  2.8784 0.0052049 **
variety3           4.7667         0     2.5593 75  1.8625 0.0664519 .
```

```
variety4           2.2833         0     2.5593 75  0.8922 0.3751569
variety5           0.0000         0     0.0000 75
methoda:variety1  -6.4333         0     3.6194 75 -1.7775 0.0795479 .
methoda:variety2  -7.8500         0     3.6194 75 -2.1689 0.0332634 *
methoda:variety3  -3.9667         0     3.6194 75 -1.0959 0.2766108
methoda:variety4   1.3500         0     3.6194 75  0.3730 0.7102090
methoda:variety5   0.0000         0     0.0000 75
methodb:variety1 -10.0000         0     3.6194 75 -2.7629 0.0072031 **
methodb:variety2 -11.3500         0     3.6194 75 -3.1359 0.0024473 **
methodb:variety3  -8.5333         0     3.6194 75 -2.3577 0.0210000 *
methodb:variety4  -8.0000         0     3.6194 75 -2.2103 0.0301340 *
methodb:variety5   0.0000         0     0.0000 75
methodc:variety1   0.0000         0     0.0000 75
methodc:variety2   0.0000         0     0.0000 75
methodc:variety3   0.0000         0     0.0000 75
methodc:variety4   0.0000         0     0.0000 75
methodc:variety5   0.0000         0     0.0000 75
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.3 Chapter 4

5.3.1 p94

(26) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)          4.0380         0    0.13870 60 29.1124 < 2.2e-16 ***
package1            -0.6942         0    0.19616 60 -3.5391 0.0007825 ***
package2            -1.4062         0    0.19616 60 -7.1689 1.288e-09 ***
package3            -0.8099         0    0.19616 60 -4.1290 0.0001143 ***
package4            -0.4040         0    0.19616 60 -2.0595 0.0437975 *
package5            -1.3788         0    0.19616 60 -7.0292 2.231e-09 ***
package6            -1.6673         0    0.19616 60 -8.4999 6.910e-12 ***
package7            -0.2562         0    0.19616 60 -1.3063 0.1964519
package8            -1.7274         0    0.19616 60 -8.8062 2.094e-12 ***
package9            -1.0124         0    0.19616 60 -5.1611 2.924e-06 ***
package10           -1.7144         0    0.19616 60 -8.7402 2.707e-12 ***
package11           -0.9731         0    0.19616 60 -4.9609 6.100e-06 ***
package12           -0.8359         0    0.19616 60 -4.2616 7.279e-05 ***
package13           -0.7625         0    0.19616 60 -3.8873 0.0002560 ***
package14           -1.5190         0    0.19616 60 -7.7440 1.340e-10 ***
package15           -1.3985         0    0.19616 60 -7.1297 1.503e-09 ***
package16            0.0540         0    0.19616 60  0.2751 0.7841687
package17           -1.0624         0    0.19616 60 -5.4160 1.132e-06 ***
package18           -1.4658         0    0.19616 60 -7.4729 3.896e-10 ***
package19           -0.0892         0    0.19616 60 -0.4546 0.6510110
package20            0.0000         0    0.00000 60
package1:sampleA1   -0.5257         0    0.19616 60 -2.6800 0.0094902 **
package1:sampleA2   -1.0912         0    0.19616 60 -5.5631 6.503e-07 ***
package1:sampleA3    0.0000         0    0.00000 60
package2:sampleA1    0.7757         0    0.19616 60  3.9548 0.0002049 ***
```

```
package2:sampleA2    0.9866         0    0.19616 60  5.0298 4.741e-06 ***
package2:sampleA3    0.0000         0    0.00000 60
package3:sampleA1   -0.3974         0    0.19616 60 -2.0262 0.0472007 *
package3:sampleA2   -0.2931         0    0.19616 60 -1.4940 0.1404174
package3:sampleA3    0.0000         0    0.00000 60
package4:sampleA1   -0.3198         0    0.19616 60 -1.6301 0.1083175
package4:sampleA2   -1.6365         0    0.19616 60 -8.3426 1.278e-11 ***
package4:sampleA3    0.0000         0    0.00000 60
package5:sampleA1    0.8826         0    0.19616 60  4.4993 3.188e-05 ***
package5:sampleA2    0.6156         0    0.19616 60  3.1382 0.0026355 **
package5:sampleA3    0.0000         0    0.00000 60
package6:sampleA1   -0.7341         0    0.19616 60 -3.7422 0.0004105 ***
package6:sampleA2   -0.4318         0    0.19616 60 -2.2011 0.0315906 *
package6:sampleA3    0.0000         0    0.00000 60
package7:sampleA1   -0.5654         0    0.19616 60 -2.8825 0.0054684 **
package7:sampleA2   -0.0688         0    0.19616 60 -0.3508 0.7269701
package7:sampleA3    0.0000         0    0.00000 60
package8:sampleA1   -0.1137         0    0.19616 60 -0.5795 0.5644332
package8:sampleA2    0.3757         0    0.19616 60  1.9153 0.0602278 .
package8:sampleA3    0.0000         0    0.00000 60
package9:sampleA1   -0.2718         0    0.19616 60 -1.3854 0.1710573
package9:sampleA2   -0.0803         0    0.19616 60 -0.4095 0.6836214
package9:sampleA3    0.0000         0    0.00000 60
package10:sampleA1   0.3684         0    0.19616 60  1.8779 0.0652619 .
package10:sampleA2  -0.5756         0    0.19616 60 -2.9345 0.0047275 **
package10:sampleA3   0.0000         0    0.00000 60
package11:sampleA1   0.3030         0    0.19616 60  1.5446 0.1277034
package11:sampleA2   0.3470         0    0.19616 60  1.7690 0.0819836 .
package11:sampleA3   0.0000         0    0.00000 60
package12:sampleA1   0.4875         0    0.19616 60  2.4851 0.0157584 *
package12:sampleA2   0.4577         0    0.19616 60  2.3333 0.0230013 *
package12:sampleA3   0.0000         0    0.00000 60
package13:sampleA1  -0.2737         0    0.19616 60 -1.3953 0.1680716
package13:sampleA2  -1.2309         0    0.19616 60 -6.2752 4.243e-08 ***
package13:sampleA3   0.0000         0    0.00000 60
package14:sampleA1   0.6523         0    0.19616 60  3.3256 0.0015089 **
package14:sampleA2   1.6004         0    0.19616 60  8.1590 2.625e-11 ***
package14:sampleA3   0.0000         0    0.00000 60
package15:sampleA1   0.8492         0    0.19616 60  4.3291 5.770e-05 ***
package15:sampleA2  -0.5446         0    0.19616 60 -2.7764 0.0073206 **
package15:sampleA3   0.0000         0    0.00000 60
package16:sampleA1   0.6186         0    0.19616 60  3.1538 0.0025178 **
package16:sampleA2  -0.1946         0    0.19616 60 -0.9923 0.3250282
package16:sampleA3   0.0000         0    0.00000 60
package17:sampleA1   0.3223         0    0.19616 60  1.6429 0.1056276
package17:sampleA2  -0.7938         0    0.19616 60 -4.0467 0.0001508 ***
package17:sampleA3   0.0000         0    0.00000 60
package18:sampleA1   0.9477         0    0.19616 60  4.8314 9.762e-06 ***
```

```
package18:sampleA2   0.1888         0    0.19616 60  0.9623 0.3397458
package18:sampleA3   0.0000         0    0.00000 60
package19:sampleA1  -0.1623         0    0.19616 60 -0.8273 0.4113450
package19:sampleA2  -0.8111         0    0.19616 60 -4.1352 0.0001120 ***
package19:sampleA3   0.0000         0    0.00000 60
package20:sampleA1  -1.0114         0    0.19616 60 -5.1560 2.980e-06 ***
package20:sampleA2  -0.5923         0    0.19616 60 -3.0197 0.0037126 **
package20:sampleA3   0.0000         0    0.00000 60
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.3.2 p116

(27) MODEL

```r
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
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)       12.5500         0     1.8097 75  6.9348  1.23e-09 ***
methoda            9.7833         0     2.5593 75  3.8226 0.0002707 ***
methodb            6.6667         0     2.5593 75  2.6049 0.0110772 *
methodc            0.0000         0     0.0000 75
variety1           5.8667         0     2.5593 75  2.2923 0.0246955 *
variety2           7.3667         0     2.5593 75  2.8784 0.0052049 **
variety3           4.7667         0     2.5593 75  1.8625 0.0664519 .
variety4           2.2833         0     2.5593 75  0.8922 0.3751569
variety5           0.0000         0     0.0000 75
methoda:variety1  -6.4333         0     3.6194 75 -1.7775 0.0795479 .
methoda:variety2  -7.8500         0     3.6194 75 -2.1689 0.0332634 *
methoda:variety3  -3.9667         0     3.6194 75 -1.0959 0.2766108
methoda:variety4   1.3500         0     3.6194 75  0.3730 0.7102090
methoda:variety5   0.0000         0     0.0000 75
methodb:variety1 -10.0000         0     3.6194 75 -2.7629 0.0072031 **
methodb:variety2 -11.3500         0     3.6194 75 -3.1359 0.0024473 **
methodb:variety3  -8.5333         0     3.6194 75 -2.3577 0.0210000 *
methodb:variety4  -8.0000         0     3.6194 75 -2.2103 0.0301340 *
methodb:variety5   0.0000         0     0.0000 75
methodc:variety1   0.0000         0     0.0000 75
methodc:variety2   0.0000         0     0.0000 75
methodc:variety3   0.0000         0     0.0000 75
methodc:variety4   0.0000         0     0.0000 75
methodc:variety5   0.0000         0     0.0000 75
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.3.3 p122

(28) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   6.1775         0    0.23574 24 26.2044 < 2.2e-16 ***
et1          -0.8017         0    0.33339 24 -2.4046  0.024265 *
et2          -0.1792         0    0.33339 24 -0.5374  0.595934
et3          -0.0467         0    0.33339 24 -0.1400  0.889847
et4           0.0000         0    0.00000 24
et1:wafer1    0.7025         0    0.23574 24  2.9799  0.006508 **
et1:wafer2    0.8300         0    0.23574 24  3.5208  0.001750 **
et1:wafer3    0.0000         0    0.00000 24
et2:wafer1   -0.0800         0    0.23574 24 -0.3394  0.737295
et2:wafer2   -0.1650         0    0.23574 24 -0.6999  0.490709
et2:wafer3    0.0000         0    0.00000 24
et3:wafer1   -0.5125         0    0.23574 24 -2.1740  0.039796 *
et3:wafer2    0.4000         0    0.23574 24  1.6968  0.102675
et3:wafer3    0.0000         0    0.00000 24
et4:wafer1    0.6850         0    0.23574 24  2.9057  0.007755 **
et4:wafer2    0.4025         0    0.23574 24  1.7074  0.100660
et4:wafer3    0.0000         0    0.00000 24
pos1         -0.2000         0    0.27221 24 -0.7347  0.469628
pos2          0.0133         0    0.27221 24  0.0490  0.961339
pos3         -0.6433         0    0.27221 24 -2.3634  0.026551 *
pos4          0.0000         0    0.00000 24
```

```
et1:pos1     -0.0733         0    0.38497 24 -0.1905  0.850525
et1:pos2     -0.4500         0    0.38497 24 -1.1689  0.253910
et1:pos3      0.3100         0    0.38497 24  0.8053  0.428573
et1:pos4      0.0000         0    0.00000 24
et2:pos1      0.2767         0    0.38497 24  0.7187  0.479279
et2:pos2      0.2567         0    0.38497 24  0.6667  0.511307
et2:pos3      0.4933         0    0.38497 24  1.2815  0.212262
et2:pos4      0.0000         0    0.00000 24
et3:pos1      0.2433         0    0.38497 24  0.6321  0.533304
et3:pos2      0.2400         0    0.38497 24  0.6234  0.538882
et3:pos3      0.3233         0    0.38497 24  0.8399  0.409254
et3:pos4      0.0000         0    0.00000 24
et4:pos1      0.0000         0    0.00000 24
et4:pos2      0.0000         0    0.00000 24
et4:pos3      0.0000         0    0.00000 24
et4:pos4      0.0000         0    0.00000 24
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.3.4 p136

(29) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)    31.4917         0    0.59389 12 53.0259 1.332e-15 ***
rep1            3.4000         0    0.68577 12  4.9579 0.0003319 ***
rep2            3.8000         0    0.68577 12  5.5412 0.0001275 ***
rep3            0.9333         0    0.68577 12  1.3610 0.1985240
rep4            0.0000         0    0.00000 12
cultA           0.6917         0    0.83989 12  0.8235 0.4262768
cultB           0.0000         0    0.00000 12
rep1:cultA     -2.0000         0    0.96982 12 -2.0622 0.0615275 .
rep1:cultB      0.0000         0    0.00000 12
rep2:cultA     -2.6000         0    0.96982 12 -2.6809 0.0200035 *
rep2:cultB      0.0000         0    0.00000 12
rep3:cultA      0.3333         0    0.96982 12  0.3437 0.7370149
rep3:cultB      0.0000         0    0.00000 12
rep4:cultA      0.0000         0    0.00000 12
rep4:cultB      0.0000         0    0.00000 12
inocCON        -5.5000         0    0.59389 12 -9.2609 8.156e-07 ***
inocDEA        -2.8750         0    0.59389 12 -4.8409 0.0004044 ***
inocLIV         0.0000         0    0.00000 12
cultA:inocCON   0.2500         0    0.83989 12  0.2977 0.7710547
cultA:inocDEA  -1.0250         0    0.83989 12 -1.2204 0.2457544
cultA:inocLIV   0.0000         0    0.00000 12
cultB:inocCON   0.0000         0    0.00000 12
cultB:inocDEA   0.0000         0    0.00000 12
cultB:inocLIV   0.0000         0    0.00000 12
---
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)  20.7038         0     5.1627 71  4.0103 0.0001481 ***
STUDY42      18.8049         0    11.1730 71  1.6831 0.0967562 .
STUDY43       3.3539         0     5.8408 71  0.5742 0.5676300
STUDY44      -9.6707         0     7.1273 71 -1.3569 0.1791234
STUDY45       9.6932         0     6.0879 71  1.5922 0.1157835
STUDY46       0.0000         0     0.0000 71
TRTA         -1.8583         0     3.9782 71 -0.4671 0.6418492
```

```
TRTB          0.0000         0     0.0000 71
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(31) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   24.2321         0     6.6940 67  3.6200 0.0005671 ***
TRTA          -9.5030         0     9.8532 67 -0.9645 0.3382875
TRTB           0.0000         0     0.0000 67
STUDY42        4.1012         0    18.9334 67  0.2166 0.8291705
STUDY43        0.3108         0     8.1984 67  0.0379 0.9698723
STUDY44      -12.8822         0     9.8532 67 -1.3074 0.1955439
STUDY45        4.1451         0     8.5629 67  0.4841 0.6299091
STUDY46        0.0000         0     0.0000 67
```

```
TRTA:STUDY42  24.4078         0    23.8240 67  1.0245 0.3092815
TRTA:STUDY43   6.6743         0    11.9120 67  0.5603 0.5771416
TRTA:STUDY44   6.9476         0    14.5635 67  0.4771 0.6348740
TRTA:STUDY45  11.6841         0    12.4143 67  0.9412 0.3499931
TRTA:STUDY46   0.0000         0     0.0000 67
TRTB:STUDY42   0.0000         0     0.0000 67
TRTB:STUDY43   0.0000         0     0.0000 67
TRTB:STUDY44   0.0000         0     0.0000 67
TRTB:STUDY45   0.0000         0     0.0000 67
TRTB:STUDY46   0.0000         0     0.0000 67
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.5 Chapter 6

5.5.1 p171

(32) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)   72.455         0     2.0097 28 36.0530   <2e-16 ***
teachJAY       3.545         0     3.3828 28  1.0481   0.3036
teachPAT       0.903         0     2.6855 28  0.3361   0.7393
teachROBIN     0.000         0     0.0000 28
---
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
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   5.4000         0    0.65912 12  8.1927 2.944e-06 ***
a1           -4.4000         0    1.61452 12 -2.7253  0.018427 *
a2            0.0000         0    0.00000 12
b1           -2.9000         0    1.23311 12 -2.3518  0.036594 *
b2            2.9333         0    1.07634 12  2.7253  0.018427 *
b3            0.0000         0    0.00000 12
```

```
a1:b1         7.4000         0    2.18607 12  3.3851  0.005417 **
a1:b2         0.6667         0    1.94041 12  0.3436  0.737114
a1:b3         0.0000         0    0.00000 12
a2:b1         0.0000         0    0.00000 12
a2:b2         0.0000         0    0.00000 12
a2:b3         0.0000         0    0.00000 12
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.5.3 p203

(34) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   5.4000         0    0.65912 12  8.1927 2.944e-06 ***
a1           -3.7333         0    1.07634 12 -3.4685  0.004644 **
a2            0.0000         0    0.00000 12
b1           -2.9000         0    1.23311 12 -2.3518  0.036594 *
b2            2.9333         0    1.07634 12  2.7253  0.018427 *
b3            0.0000         0    0.00000 12
a1:b1         6.7333         0    1.82503 12  3.6894  0.003095 **
a1:b2         0.0000         0    0.00000 12
a1:b3                        0
a2:b1         0.0000         0    0.00000 12
a2:b2         0.0000         0    0.00000 12
a2:b3         0.0000         0    0.00000 12
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.5.4 p215

(35) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   30.6667         0     2.5609  6 11.9750 2.055e-05 ***
irrig1         2.6333         0     3.6216  6  0.7271    0.4945
irrig2         3.5833         0     3.6216  6  0.9894    0.3607
irrig3         0.0000         0     0.0000  6
irrig1:reps1  -4.9000         0     3.1364  6 -1.5623    0.1692
irrig1:reps2  -1.5000         0     3.1364  6 -0.4783    0.6494
irrig1:reps3   0.0000         0     0.0000  6
irrig2:reps1  -5.6000         0     3.1364  6 -1.7855    0.1244
irrig2:reps2  -3.3500         0     3.1364  6 -1.0681    0.3266
irrig2:reps3   0.0000         0     0.0000  6
irrig3:reps1  -1.7000         0     3.1364  6 -0.5420    0.6073
irrig3:reps2  -0.8000         0     3.1364  6 -0.2551    0.8072
irrig3:reps3   0.0000         0     0.0000  6
cultA          0.3667         0     2.5609  6  0.1432    0.8908
cultB          0.0000         0     0.0000  6
irrig1:cultA  -0.0667         0     3.6216  6 -0.0184    0.9859
irrig1:cultB   0.0000         0     0.0000  6
irrig2:cultA  -0.0667         0     3.6216  6 -0.0184    0.9859
irrig2:cultB   0.0000         0     0.0000  6
irrig3:cultA   0.0000         0     0.0000  6
irrig3:cultB   0.0000         0     0.0000  6
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
# Compare with SAS output
```

(36) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   30.6667         0     2.5609  6 11.9750 2.055e-05 ***
reps1         -1.7000         0     3.1364  6 -0.5420    0.6073
reps2         -0.8000         0     3.1364  6 -0.2551    0.8072
reps3          0.0000         0     0.0000  6
irrig1         2.6333         0     3.6216  6  0.7271    0.4945
irrig2         3.5833         0     3.6216  6  0.9894    0.3607
irrig3         0.0000         0     0.0000  6
reps1:irrig1  -3.2000         0     4.4356  6 -0.7214    0.4978
reps1:irrig2  -3.9000         0     4.4356  6 -0.8793    0.4131
reps1:irrig3   0.0000         0     0.0000  6
reps2:irrig1  -0.7000         0     4.4356  6 -0.1578    0.8798
reps2:irrig2  -2.5500         0     4.4356  6 -0.5749    0.5863
reps2:irrig3   0.0000         0     0.0000  6
reps3:irrig1   0.0000         0     0.0000  6
reps3:irrig2   0.0000         0     0.0000  6
reps3:irrig3   0.0000         0     0.0000  6
cultA          0.3667         0     2.5609  6  0.1432    0.8908
cultB          0.0000         0     0.0000  6
irrig1:cultA  -0.0667         0     3.6216  6 -0.0184    0.9859
irrig1:cultB   0.0000         0     0.0000  6
irrig2:cultA  -0.0667         0     3.6216  6 -0.0184    0.9859
irrig2:cultB   0.0000         0     0.0000  6
irrig3:cultA   0.0000         0     0.0000  6
irrig3:cultB   0.0000         0     0.0000  6
---
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)  2.49486         0    1.02786 14  2.4272  0.029298 *
trt1        -0.24446         0    0.57658 14 -0.4240  0.678022
trt2        -0.28027         0    0.49291 14 -0.5686  0.578630
trt3         1.65476         0    0.42943 14  3.8534  0.001756 **
trt4         1.10711         0    0.47175 14  2.3468  0.034170 *
trt5         0.00000         0    0.00000 14
initial      1.08318         1    0.04762 14 22.7461 1.867e-12 ***
```

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

5.6.2 p240

(38) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   -0.4318         0     2.1328 10 -0.2025    0.8436
initial        1.2239         0     0.1017 10 12.0298 2.854e-07 ***
trt1           5.6731         0     3.5715 10  1.5884    0.1433
trt2          -8.7175         0     8.9578 10 -0.9732    0.3534
trt3           5.2498         0     3.4875 10  1.5053    0.1632
```

```
trt4           4.7276         0     2.9399 10  1.6081    0.1389
trt5           0.0000         0     0.0000 10
initial:trt1  -0.2412         0     0.1398 10 -1.7256    0.1151
initial:trt2   0.2775         0     0.3358 10  0.8263    0.4279
initial:trt3  -0.1678         0     0.1509 10 -1.1123    0.2920
initial:trt4  -0.1670         0     0.1269 10 -1.3153    0.2178
initial:trt5   0.0000         0     0.0000 10
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.6.3 p241

(39) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   73.273         0    13.4837 24  5.4341  1.39e-05 ***
P1            -1.225         0     0.2652 24 -4.6199 0.0001092 ***
DAY1         -54.597         0    19.7355 24 -2.7664 0.0107321 *
DAY2         -34.786         0    20.2511 24 -1.7177 0.0987253 .
DAY3         -27.943         0    29.4284 24 -0.9495 0.3518193
DAY4         -24.123         0    21.3933 24 -1.1276 0.2706307
DAY5           4.626         0    30.6284 24  0.1510 0.8812016
DAY6           0.000         0     0.0000 24
P1:DAY1        1.005         0     0.3941 24  2.5494 0.0175983 *
P1:DAY2        0.602         0     0.3988 24  1.5088 0.1444129
P1:DAY3        0.614         0     0.5703 24  1.0768 0.2922646
P1:DAY4        0.430         0     0.4151 24  1.0349 0.3110314
P1:DAY5        0.029         0     0.5703 24  0.0515 0.9593643
P1:DAY6        0.000         0     0.0000 24
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.6.4 p243

(40) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   73.273         0    13.4837 24  5.4341  1.39e-05 ***
DAY1         -54.597         0    19.7355 24 -2.7664 0.0107321 *
DAY2         -34.786         0    20.2511 24 -1.7177 0.0987253 .
DAY3         -27.943         0    29.4284 24 -0.9495 0.3518193
DAY4         -24.123         0    21.3933 24 -1.1276 0.2706307
DAY5           4.626         0    30.6284 24  0.1510 0.8812016
DAY6           0.000         0     0.0000 24
DAY1:P1       -0.220         1     0.2915 24 -0.7562 0.4568599
DAY2:P1       -0.624         1     0.2978 24 -2.0940 0.0470031 *
DAY3:P1       -0.611         1     0.5049 24 -1.2102 0.2379998
DAY4:P1       -0.796         1     0.3193 24 -2.4914 0.0200350 *
DAY5:P1       -1.196         1     0.5049 24 -2.3683 0.0262648 *
DAY6:P1       -1.225         1     0.2652 24 -4.6199 0.0001092 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
REG(Q1 ~ DAY + DAY:P1 - 1, p241) # Ouput 7.10
```

```
        Estimate Std. Error Df t value  Pr(>|t|)
DAY1      18.675    14.4110 24  1.2959 0.2073286
DAY2      38.487    15.1094 24  2.5472 0.0176863 *
DAY3      45.330    26.1576 24  1.7329 0.0959384 .
DAY4      49.149    16.6092 24  2.9592 0.0068366 **
DAY5      77.899    27.5007 24  2.8326 0.0092034 **
DAY6      73.273    13.4837 24  5.4341  1.39e-05 ***
DAY1:P1   -0.220     0.2915 24 -0.7562 0.4568599
DAY2:P1   -0.624     0.2978 24 -2.0940 0.0470031 *
DAY3:P1   -0.611     0.5049 24 -1.2102 0.2379998
DAY4:P1   -0.796     0.3193 24 -2.4914 0.0200350 *
DAY5:P1   -1.196     0.5049 24 -2.3683 0.0262648 *
DAY6:P1   -1.225     0.2652 24 -4.6199 0.0001092 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(41) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   73.273         0    13.4837 24  5.4341  1.39e-05 ***
P1            -1.225         0     0.2652 24 -4.6199 0.0001092 ***
DAY1         -54.597         0    19.7355 24 -2.7664 0.0107321 *
DAY2         -34.786         0    20.2511 24 -1.7177 0.0987253 .
DAY3         -27.943         0    29.4284 24 -0.9495 0.3518193
DAY4         -24.123         0    21.3933 24 -1.1276 0.2706307
DAY5           4.626         0    30.6284 24  0.1510 0.8812016
DAY6           0.000         0     0.0000 24
P1:DAY1        1.005         0     0.3941 24  2.5494 0.0175983 *
P1:DAY2        0.602         0     0.3988 24  1.5088 0.1444129
P1:DAY3        0.614         0     0.5703 24  1.0768 0.2922646
P1:DAY4        0.430         0     0.4151 24  1.0349 0.3110314
P1:DAY5        0.029         0     0.5703 24  0.0515 0.9593643
P1:DAY6        0.000         0     0.0000 24
---
```

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

(42) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   51.700         0     9.7910 23  5.2803 2.333e-05 ***
STORE1        -7.645         0     2.6919 23 -2.8401  0.009273 **
STORE2        -5.602         0     2.4642 23 -2.2735  0.032650 *
STORE3        -7.363         0     2.4642 23 -2.9880  0.006573 **
STORE4        -4.365         0     2.4875 23 -1.7547  0.092620 .
```

```
STORE5        -5.021         0     2.4361 23 -2.0609  0.050799 .
STORE6         0.000         0     0.0000 23
DAY1          -5.830         0     2.5193 23 -2.3143  0.029934 *
DAY2          -4.900         0     2.4471 23 -2.0024  0.057172 .
DAY3           2.270         0     2.5403 23  0.8935  0.380834
DAY4          -2.652         0     2.4467 23 -1.0841  0.289545
DAY5           4.047         0     2.5566 23  1.5830  0.127078
DAY6           0.000         0     0.0000 23
P1            -0.830         1     0.1508 23 -5.5059 1.342e-05 ***
P2             0.149         1     0.0997 23  1.4925  0.149171
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.6.5 p250

(43) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)                 -0.27244         0   0.119340 40 -2.2829  0.027825
bollwt                       0.30561         1   0.020135 40 15.1781 < 2.2e-16
variety37                    0.42327         0   0.129645 40  3.2649  0.002249
variety213                   0.00000         0   0.000000 40
spacing30                    0.03796         0   0.151615 40  0.2504  0.803596
spacing40                    0.00000         0   0.000000 40
variety37:spacing30          0.02364         0   0.198980 40  0.1188  0.906004
variety37:spacing40          0.00000         0   0.000000 40
variety213:spacing30         0.00000         0   0.000000 40
variety213:spacing40         0.00000         0   0.000000 40
variety37:spacing30:plant0                   0
variety37:spacing30:plant3   0.08923         0   0.150334 40  0.5935  0.556164
variety37:spacing30:plant5   0.00000         0   0.000000 40
variety37:spacing40:plant0                   0
variety37:spacing40:plant3  -0.02713         0   0.110857 40 -0.2447  0.807910
variety37:spacing40:plant5   0.00000         0   0.000000 40
variety213:spacing30:plant0                  0
variety213:spacing30:plant3  0.33372         0   0.160556 40  2.0785  0.044120
variety213:spacing30:plant5  0.00000         0   0.000000 40
variety213:spacing40:plant0 -0.09849         0   0.111519 40 -0.8832  0.382418
variety213:spacing40:plant3  0.00000         0   0.000000 40
variety213:spacing40:plant5                  0

(Intercept)                 *
bollwt                      ***
variety37                   **
variety213
spacing30
spacing40
variety37:spacing30
variety37:spacing40
variety213:spacing30
variety213:spacing40
variety37:spacing30:plant0
```

```
variety37:spacing30:plant3
variety37:spacing30:plant5
variety37:spacing40:plant0
variety37:spacing40:plant3
variety37:spacing40:plant5
variety213:spacing30:plant0
variety213:spacing30:plant3 *
variety213:spacing30:plant5
variety213:spacing40:plant0
variety213:spacing40:plant3
variety213:spacing40:plant5
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.6.6 p254 Output 7.20

(44) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept) -0.27695         0   0.103845 45 -2.6670  0.010598 *
bollwt       0.30144         1   0.019995 45 15.0759 < 2.2e-16 ***
variety37    0.41066         0   0.084682 45  4.8494 1.516e-05 ***
variety213   0.00000         0   0.000000 45
spacing30    0.20521         0   0.067782 45  3.0275  0.004072 **
spacing40    0.00000         0   0.000000 45
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.6.7 p256

(45) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)      62.042         0     2.5123 15 24.6955 1.457e-13 ***
bloc1             7.667         0     2.3686 15  3.2368  0.005531 **
bloc2            -3.500         0     2.3686 15 -1.4777  0.160183
bloc3            -4.333         0     2.3686 15 -1.8295  0.087270 .
bloc4             0.000         0     0.0000 15
type1            -8.000         0     2.9009 15 -2.7578  0.014656 *
type2             0.000         0     0.0000 15
logdose0        -11.250         0     2.9009 15 -3.8781  0.001486 **
logdose1         -7.750         0     2.9009 15 -2.6716  0.017423 *
logdose2          0.000         0     0.0000 15
type1:logdose0   11.750         0     4.1025 15  2.8641  0.011824 *
type1:logdose1    8.000         0     4.1025 15  1.9500  0.070117 .
type1:logdose2    0.000         0     0.0000 15
type2:logdose0    0.000         0     0.0000 15
type2:logdose1    0.000         0     0.0000 15
type2:logdose2    0.000         0     0.0000 15
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.6.8 p261 Output 7.27

(46) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)     50.792         0     2.5123 15 20.2175 2.697e-12 ***
bloc1            7.667         0     2.3686 15  3.2368  0.005531 **
bloc2           -3.500         0     2.3686 15 -1.4777  0.160183
bloc3           -4.333         0     2.3686 15 -1.8295  0.087270 .
bloc4            0.000         0     0.0000 15
type1            3.750         0     2.9009 15  1.2927  0.215674
type2            0.000         0     0.0000 15
logdose          1.375         0     5.2297 15  0.2629  0.796188
logd2            2.125         0     2.5123 15  0.8459  0.410926
type1:logdose   -1.625         0     7.3959 15 -0.2197  0.829054
type2:logdose    0.000         0     0.0000 15
type1:logd2     -2.125         0     3.5529 15 -0.5981  0.558692
type2:logd2      0.000         0     0.0000 15
---
```

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

5.6.9 p262 Output 7.28

(47) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)      62.042         0     2.5123 15 24.6955 1.457e-13 ***
bloc1             7.667         0     2.3686 15  3.2368  0.005531 **
bloc2            -3.500         0     2.3686 15 -1.4777  0.160183
bloc3            -4.333         0     2.3686 15 -1.8295  0.087270 .
bloc4             0.000         0     0.0000 15
type1            -8.000         0     2.9009 15 -2.7578  0.014656 *
```

```
type2             0.000         0     0.0000 15
type1:logdose0    0.500         0     2.9009 15  0.1724  0.865459
type1:logdose1    0.250         0     2.9009 15  0.0862  0.932463
type1:logdose2    0.000         0     0.0000 15
type2:logdose0  -11.250         0     2.9009 15 -3.8781  0.001486 **
type2:logdose1   -7.750         0     2.9009 15 -2.6716  0.017423 *
type2:logdose2    0.000         0     0.0000 15
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.7 Chapter 8

5.7.1 p269

(48) MODEL

```r
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 Estimable Std. Error  Df  t value  Pr(>|t|)
(Intercept)       2.89349         0    0.10096 483  28.6606 < 2.2e-16 ***
druga             0.03458         0    0.14278 483   0.2422 0.8087105
drugc             0.63172         0    0.14278 483   4.4246 1.195e-05 ***
drugp             0.00000         0    0.00000 483
druga:patient201 -0.76375         0    0.12562 483  -6.0796 2.449e-09 ***
druga:patient202 -0.02375         0    0.12562 483  -0.1891 0.8501297
druga:patient203 -0.90875         0    0.12562 483  -7.2338 1.855e-12 ***
druga:patient204  0.31875         0    0.12562 483   2.5373 0.0114843 *
druga:patient205  0.32125         0    0.12562 483   2.5572 0.0108561 *
druga:patient206  0.20875         0    0.12562 483   1.6617 0.0972242 .
druga:patient207  0.00875         0    0.12562 483   0.0697 0.9444998
druga:patient208 -0.25500         0    0.12562 483  -2.0298 0.0429198 *
druga:patient209  0.31125         0    0.12562 483   2.4776 0.0135676 *
druga:patient210 -0.47500         0    0.12562 483  -3.7811 0.0001757 ***
druga:patient211  0.34375         0    0.12562 483   2.7363 0.0064421 **
druga:patient212 -1.29750         0    0.12562 483 -10.3283 < 2.2e-16 ***
druga:patient214  0.04125         0    0.12562 483   0.3284 0.7427837
druga:patient215  0.41000         0    0.12562 483   3.2637 0.0011777 **
druga:patient216  0.47250         0    0.12562 483   3.7612 0.0001899 ***
druga:patient217 -1.71625         0    0.12562 483 -13.6617 < 2.2e-16 ***
druga:patient218 -0.35000         0    0.12562 483  -2.7861 0.0055451 **
druga:patient219  0.07000         0    0.12562 483   0.5572 0.5776402
druga:patient220 -0.43875         0    0.12562 483  -3.4925 0.0005224 ***
druga:patient221  0.63125         0    0.12562 483   5.0249 7.106e-07 ***
druga:patient222 -0.04375         0    0.12562 483  -0.3483 0.7277982
druga:patient223  0.98500         0    0.12562 483   7.8408 2.887e-14 ***
druga:patient224  0.83625         0    0.12562 483   6.6567 7.624e-11 ***
druga:patient232  0.00000         0    0.00000 483
drugc:patient201 -0.53000         0    0.12562 483  -4.2189 2.933e-05 ***
drugc:patient202 -0.42250         0    0.12562 483  -3.3632 0.0008318 ***
drugc:patient203 -1.53375         0    0.12562 483 -12.2089 < 2.2e-16 ***
drugc:patient204 -0.21000         0    0.12562 483  -1.6716 0.0952434 .
drugc:patient205  0.32375         0    0.12562 483   2.5771 0.0102586 *
drugc:patient206  0.11750         0    0.12562 483   0.9353 0.3500901
drugc:patient207 -1.72750         0    0.12562 483 -13.7512 < 2.2e-16 ***
drugc:patient208 -0.43625         0    0.12562 483  -3.4726 0.0005617 ***
drugc:patient209 -0.25500         0    0.12562 483  -2.0298 0.0429198 *
drugc:patient210 -1.08250         0    0.12562 483  -8.6169 < 2.2e-16 ***
drugc:patient211 -0.74500         0    0.12562 483  -5.9303 5.765e-09 ***
```

```
drugc:patient212 -1.72375         0    0.12562 483 -13.7214 < 2.2e-16 ***
drugc:patient214 -0.68625         0    0.12562 483  -5.4627 7.522e-08 ***
drugc:patient215  0.09875         0    0.12562 483   0.7861 0.4322131
drugc:patient216  0.05375         0    0.12562 483   0.4279 0.6689439
drugc:patient217 -1.91875         0    0.12562 483 -15.2736 < 2.2e-16 ***
drugc:patient218 -0.78250         0    0.12562 483  -6.2288 1.023e-09 ***
drugc:patient219 -0.84875         0    0.12562 483  -6.7562 4.087e-11 ***
drugc:patient220 -1.01000         0    0.12562 483  -8.0398 7.105e-15 ***
drugc:patient221  0.23250         0    0.12562 483   1.8507 0.0648170 .
drugc:patient222 -0.60625         0    0.12562 483  -4.8259 1.873e-06 ***
drugc:patient223  0.96000         0    0.12562 483   7.6418 1.164e-13 ***
drugc:patient224  0.22750         0    0.12562 483   1.8109 0.0707711 .
drugc:patient232  0.00000         0    0.00000 483
drugp:patient201 -0.63250         0    0.12562 483  -5.0348 6.764e-07 ***
drugp:patient202 -0.04500         0    0.12562 483  -0.3582 0.7203440
drugp:patient203 -1.27250         0    0.12562 483 -10.1293 < 2.2e-16 ***
drugp:patient204  0.34750         0    0.12562 483   2.7662 0.0058894 **
drugp:patient205  0.60625         0    0.12562 483   4.8259 1.873e-06 ***
drugp:patient206  0.11500         0    0.12562 483   0.9154 0.3604275
drugp:patient207 -0.55875         0    0.12562 483  -4.4478 1.078e-05 ***
drugp:patient208 -0.57000         0    0.12562 483  -4.5373 7.199e-06 ***
drugp:patient209  0.35000         0    0.12562 483   2.7861 0.0055451 **
drugp:patient210 -0.36875         0    0.12562 483  -2.9353 0.0034909 **
drugp:patient211 -0.26375         0    0.12562 483  -2.0995 0.0362913 *
drugp:patient212 -1.18000         0    0.12562 483  -9.3930 < 2.2e-16 ***
drugp:patient214 -0.30625         0    0.12562 483  -2.4378 0.0151363 *
drugp:patient215 -0.06250         0    0.12562 483  -0.4975 0.6190549
drugp:patient216  0.24000         0    0.12562 483   1.9104 0.0566680 .
drugp:patient217 -1.80375         0    0.12562 483 -14.3582 < 2.2e-16 ***
drugp:patient218 -0.28750         0    0.12562 483  -2.2886 0.0225363 *
drugp:patient219 -0.14375         0    0.12562 483  -1.1443 0.2530759
drugp:patient220 -0.21125         0    0.12562 483  -1.6816 0.0932951 .
drugp:patient221  0.78375         0    0.12562 483   6.2388 9.646e-10 ***
drugp:patient222 -0.06500         0    0.12562 483  -0.5174 0.6051056
drugp:patient223  0.38000         0    0.12562 483   3.0249 0.0026199 **
drugp:patient224  0.79500         0    0.12562 483   6.3283 5.662e-10 ***
drugp:patient232  0.00000         0    0.00000 483
hour1             0.09458         0    0.07253 483   1.3041 0.1928336
hour2             0.16042         0    0.07253 483   2.2117 0.0274523 *
hour3             0.16583         0    0.07253 483   2.2864 0.0226619 *
hour4             0.13917         0    0.07253 483   1.9188 0.0556048 .
hour5             0.03625         0    0.07253 483   0.4998 0.6174473
hour6             0.08333         0    0.07253 483   1.1490 0.2511439
hour7             0.05250         0    0.07253 483   0.7238 0.4695140
hour8             0.00000         0    0.00000 483
druga:hour1       0.52083         0    0.10257 483   5.0777 5.464e-07 ***
druga:hour2       0.37833         0    0.10257 483   3.6884 0.0002513 ***
druga:hour3       0.16000         0    0.10257 483   1.5599 0.1194454
```

```
druga:hour4       0.04917         0    0.10257 483   0.4793 0.6319171
druga:hour5       0.15917         0    0.10257 483   1.5517 0.1213779
druga:hour6       0.03792         0    0.10257 483   0.3697 0.7118002
druga:hour7      -0.04208         0    0.10257 483  -0.4103 0.6817836
druga:hour8       0.00000         0    0.00000 483
drugc:hour1       0.58625         0    0.10257 483   5.7155 1.917e-08 ***
drugc:hour2       0.45583         0    0.10257 483   4.4440 1.096e-05 ***
drugc:hour3       0.40125         0    0.10257 483   3.9119 0.0001047 ***
drugc:hour4       0.29417         0    0.10257 483   2.8679 0.0043130 **
drugc:hour5       0.20292         0    0.10257 483   1.9783 0.0484656 *
drugc:hour6      -0.00833         0    0.10257 483  -0.0812 0.9352821
drugc:hour7      -0.08583         0    0.10257 483  -0.8368 0.4031156
drugc:hour8       0.00000         0    0.00000 483
drugp:hour1       0.00000         0    0.00000 483
drugp:hour2       0.00000         0    0.00000 483
drugp:hour3       0.00000         0    0.00000 483
drugp:hour4       0.00000         0    0.00000 483
drugp:hour5       0.00000         0    0.00000 483
drugp:hour6       0.00000         0    0.00000 483
drugp:hour7       0.00000         0    0.00000 483
drugp:hour8       0.00000         0    0.00000 483
---
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)  2.01062         0    0.25171 11  7.9879 6.627e-06 ***
rep1         0.32813         0    0.35597 11  0.9218  0.376420
rep2        -0.11000         0    0.35597 11 -0.3090  0.763085
rep3         0.00000         0    0.00000 11
rep1:blk1    0.20000         0    0.38995 11  0.5129  0.618170
rep1:blk2    0.00000         0    0.00000 11
rep2:blk1    0.87375         0    0.38995 11  2.2407  0.046645 *
```

```
rep2:blk2    0.00000         0    0.00000 11
rep3:blk1    0.66875         0    0.38995 11  1.7150  0.114346
rep3:blk2    0.00000         0    0.00000 11
ca           0.93708         1    0.09191 11 10.1955 6.090e-07 ***
cb           0.01375         1    0.09191 11  0.1496  0.883787
ca:cb       -0.26792         1    0.09191 11 -2.9149  0.014064 *
cc           1.25458         1    0.09191 11 13.6499 3.063e-08 ***
ca:cc        0.38062         1    0.11257 11  3.3813  0.006129 **
cb:cc       -0.84188         1    0.11257 11 -7.4788 1.232e-05 ***
ca:cb:cc    -0.04375         1    0.11257 11 -0.3887  0.704949
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.8.2 p394

(50) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)  2.68875         0             0
ca           0.50875         0             0
cb           0.27375         0             0
ca:cb       -0.00625         0             0
cc          -0.02625         0             0
ca:cc       -0.31625         0             0
cb:cc        0.59375         0             0
ca:cb:cc    -0.08625         0             0
cd           0.00000         0             0
ca:cd        0.00000         0             0
cb:cd        0.00000         0             0
ca:cb:cd     0.00000         0             0
```

```
cc:cd        0.00000         0             0
ca:cc:cd     0.00000         0             0
cb:cc:cd     0.00000         0             0
ca:cb:cc:cd  0.00000         0             0
```

(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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)     3.63         0             0
a0             -0.20         0             0
a1              0.00         0             0
b0             -1.55         0             0
b1              0.00         0             0
a0:b0          -0.37         0             0
a0:b1           0.00         0             0
a1:b0           0.00         0             0
a1:b1           0.00         0             0
c0             -0.33         0             0
c1              0.00         0             0
a0:c0          -1.61         0             0
a0:c1           0.00         0             0
a1:c0           0.00         0             0
a1:c1           0.00         0             0
b0:c0           2.03         0             0
b0:c1           0.00         0             0
b1:c0           0.00         0             0
b1:c1           0.00         0             0
a0:b0:c0        0.69         0             0
a0:b0:c1        0.00         0             0
a0:b1:c0        0.00         0             0
a0:b1:c1        0.00         0             0
a1:b0:c0        0.00         0             0
```

a1:b0:c1	0.00	0	0
a1:b1:c0	0.00	0	0
a1:b1:c1	0.00	0	0
d0	0.00	0	0
d1	0.00	0	0
a0:d0	0.00	0	0
a0:d1	0.00	0	0
a1:d0	0.00	0	0
a1:d1	0.00	0	0
b0:d0	0.00	0	0
b0:d1	0.00	0	0
b1:d0	0.00	0	0
b1:d1	0.00	0	0
a0:b0:d0	0.00	0	0
a0:b0:d1	0.00	0	0
a0:b1:d0	0.00	0	0
a0:b1:d1	0.00	0	0
a1:b0:d0	0.00	0	0
a1:b0:d1	0.00	0	0
a1:b1:d0	0.00	0	0
a1:b1:d1	0.00	0	0
c0:d0	0.00	0	0
c0:d1	0.00	0	0
c1:d0	0.00	0	0
c1:d1	0.00	0	0
a0:c0:d0	0.00	0	0
a0:c0:d1	0.00	0	0
a0:c1:d0	0.00	0	0
a0:c1:d1	0.00	0	0
a1:c0:d0	0.00	0	0
a1:c0:d1	0.00	0	0
a1:c1:d0	0.00	0	0
a1:c1:d1	0.00	0	0
b0:c0:d0	0.00	0	0
b0:c0:d1	0.00	0	0
b0:c1:d0	0.00	0	0
b0:c1:d1	0.00	0	0
b1:c0:d0	0.00	0	0
b1:c0:d1	0.00	0	0
b1:c1:d0	0.00	0	0
b1:c1:d1	0.00	0	0
a0:b0:c0:d0	0.00	0	0
a0:b0:c0:d1		0	
a0:b0:c1:d0		0	
a0:b0:c1:d1	0.00	0	0
a0:b1:c0:d0		0	
a0:b1:c0:d1	0.00	0	0
a0:b1:c1:d0	0.00	0	0

```
a0:b1:c1:d1                  0
a1:b0:c0:d0                  0
a1:b0:c0:d1     0.00         0             0
a1:b0:c1:d0     0.00         0             0
a1:b0:c1:d1                  0
a1:b1:c0:d0     0.00         0             0
a1:b1:c0:d1                  0
a1:b1:c1:d0                  0
a1:b1:c1:d1     0.00         0             0
```

5.8.3 p399

(52) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)  19.1375         0    1.03732  3  18.4489 0.0003475 ***
trt1         -6.8250         0    0.92781  3  -7.3560 0.0051925 **
trt2         -5.9750         0    0.92781  3  -6.4399 0.0075922 **
trt3         -2.7000         0    0.92781  3  -2.9101 0.0619928 .
trt4          0.0000         0    0.00000  3
blk1        -10.7875         0    1.03732  3 -10.3994 0.0018975 **
blk2         -9.9375         0    1.03732  3  -9.5799 0.0024133 **
blk3         -5.9750         0    1.03732  3  -5.7600 0.0103986 *
blk4         -4.2000         0    1.03732  3  -4.0489 0.0271308 *
blk5         -2.1750         0    1.13633  3  -1.9141 0.1515206
blk6          0.0000         0    0.00000  3
---
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)           88.000         0     4.7287 42 18.6097 < 2.2e-16 ***
SEQUENCEA              6.208         0     6.2319 42  0.9962 0.3248514
SEQUENCEB            -19.333         0     6.1368 42 -3.1504 0.0030025 **
SEQUENCEC             -0.479         0     6.2319 42 -0.0769 0.9390770
SEQUENCED             -1.813         0     6.2319 42 -0.2908 0.7726044
SEQUENCEE             -5.792         0     6.2319 42 -0.9294 0.3580166
SEQUENCEF              0.000         0     0.0000 42
SEQUENCEA:PATIENT1                   0
SEQUENCEA:PATIENT2                   0
SEQUENCEA:PATIENT3                   0
SEQUENCEA:PATIENT4                   0
SEQUENCEA:PATIENT5                   0
SEQUENCEA:PATIENT6                   0
SEQUENCEA:PATIENT7    -4.000         0     6.1368 42 -0.6518 0.5180764
SEQUENCEA:PATIENT8   -29.333         0     6.1368 42 -4.7799 2.168e-05 ***
SEQUENCEA:PATIENT9                   0
SEQUENCEA:PATIENT10                  0
SEQUENCEA:PATIENT11                  0
SEQUENCEA:PATIENT12                  0
SEQUENCEA:PATIENT13                  0
SEQUENCEA:PATIENT14                  0
SEQUENCEA:PATIENT15  -13.333         0     6.1368 42 -2.1727 0.0354954 *
SEQUENCEA:PATIENT16                  0
SEQUENCEA:PATIENT17    0.000         0     0.0000 42
SEQUENCEA:PATIENT18                  0
SEQUENCEA:PATIENT19                  0
SEQUENCEA:PATIENT20                  0
SEQUENCEA:PATIENT21                  0
SEQUENCEA:PATIENT22                  0
SEQUENCEA:PATIENT23                  0
```

SEQUENCEA:PATIENT24		0					
SEQUENCEB:PATIENT1	24.000	0	6.1368	42	3.9108	0.0003299	***
SEQUENCEB:PATIENT2		0					
SEQUENCEB:PATIENT3	17.333	0	6.1368	42	2.8245	0.0072135	**
SEQUENCEB:PATIENT4		0					
SEQUENCEB:PATIENT5		0					
SEQUENCEB:PATIENT6	13.333	0	6.1368	42	2.1727	0.0354954	*
SEQUENCEB:PATIENT7		0					
SEQUENCEB:PATIENT8		0					
SEQUENCEB:PATIENT9		0					
SEQUENCEB:PATIENT10		0					
SEQUENCEB:PATIENT11		0					
SEQUENCEB:PATIENT12		0					
SEQUENCEB:PATIENT13		0					
SEQUENCEB:PATIENT14		0					
SEQUENCEB:PATIENT15		0					
SEQUENCEB:PATIENT16		0					
SEQUENCEB:PATIENT17		0					
SEQUENCEB:PATIENT18		0					
SEQUENCEB:PATIENT19		0					
SEQUENCEB:PATIENT20	0.000	0	0.0000	42			
SEQUENCEB:PATIENT21		0					
SEQUENCEB:PATIENT22		0					
SEQUENCEB:PATIENT23		0					
SEQUENCEB:PATIENT24		0					
SEQUENCEC:PATIENT1		0					
SEQUENCEC:PATIENT2		0					
SEQUENCEC:PATIENT3		0					
SEQUENCEC:PATIENT4		0					
SEQUENCEC:PATIENT5	-13.333	0	6.1368	42	-2.1727	0.0354954	*
SEQUENCEC:PATIENT6		0					
SEQUENCEC:PATIENT7		0					
SEQUENCEC:PATIENT8		0					
SEQUENCEC:PATIENT9		0					
SEQUENCEC:PATIENT10	-10.667	0	6.1368	42	-1.7382	0.0895112	.
SEQUENCEC:PATIENT11		0					
SEQUENCEC:PATIENT12		0					
SEQUENCEC:PATIENT13		0					
SEQUENCEC:PATIENT14		0					
SEQUENCEC:PATIENT15		0					
SEQUENCEC:PATIENT16		0					
SEQUENCEC:PATIENT17		0					
SEQUENCEC:PATIENT18		0					
SEQUENCEC:PATIENT19		0					
SEQUENCEC:PATIENT20		0					
SEQUENCEC:PATIENT21	9.333	0	6.1368	42	1.5209	0.1357823	
SEQUENCEC:PATIENT22	0.000	0	0.0000	42			
SEQUENCEC:PATIENT23		0					

SEQUENCEC:PATIENT24		0				
SEQUENCED:PATIENT1		0				
SEQUENCED:PATIENT2		0				
SEQUENCED:PATIENT3		0				
SEQUENCED:PATIENT4	6.000	0	6.1368	42	0.9777	0.3338152
SEQUENCED:PATIENT5		0				
SEQUENCED:PATIENT6		0				
SEQUENCED:PATIENT7		0				
SEQUENCED:PATIENT8		0				
SEQUENCED:PATIENT9	7.333	0	6.1368	42	1.1950	0.2387989
SEQUENCED:PATIENT10		0				
SEQUENCED:PATIENT11		0				
SEQUENCED:PATIENT12		0				
SEQUENCED:PATIENT13	0.667	0	6.1368	42	0.1086	0.9140096
SEQUENCED:PATIENT14		0				
SEQUENCED:PATIENT15		0				
SEQUENCED:PATIENT16		0				
SEQUENCED:PATIENT17		0				
SEQUENCED:PATIENT18		0				
SEQUENCED:PATIENT19		0				
SEQUENCED:PATIENT20		0				
SEQUENCED:PATIENT21		0				
SEQUENCED:PATIENT22		0				
SEQUENCED:PATIENT23		0				
SEQUENCED:PATIENT24	0.000	0	0.0000	42		
SEQUENCEE:PATIENT1		0				
SEQUENCEE:PATIENT2		0				
SEQUENCEE:PATIENT3		0				
SEQUENCEE:PATIENT4		0				
SEQUENCEE:PATIENT5		0				
SEQUENCEE:PATIENT6		0				
SEQUENCEE:PATIENT7		0				
SEQUENCEE:PATIENT8		0				
SEQUENCEE:PATIENT9		0				
SEQUENCEE:PATIENT10		0				
SEQUENCEE:PATIENT11		0				
SEQUENCEE:PATIENT12	12.000	0	6.1368	42	1.9554	0.0572081 .
SEQUENCEE:PATIENT13		0				
SEQUENCEE:PATIENT14		0				
SEQUENCEE:PATIENT15		0				
SEQUENCEE:PATIENT16	13.333	0	6.1368	42	2.1727	0.0354954 *
SEQUENCEE:PATIENT17		0				
SEQUENCEE:PATIENT18		0				
SEQUENCEE:PATIENT19	-0.667	0	6.1368	42	-0.1086	0.9140096
SEQUENCEE:PATIENT20		0				
SEQUENCEE:PATIENT21		0				
SEQUENCEE:PATIENT22		0				
SEQUENCEE:PATIENT23	0.000	0	0.0000	42		

```
SEQUENCEE:PATIENT24                  0
SEQUENCEF:PATIENT1                   0
SEQUENCEF:PATIENT2   -18.667         0     6.1368 42 -3.0418 0.0040426 **
SEQUENCEF:PATIENT3                   0
SEQUENCEF:PATIENT4                   0
SEQUENCEF:PATIENT5                   0
SEQUENCEF:PATIENT6                   0
SEQUENCEF:PATIENT7                   0
SEQUENCEF:PATIENT8                   0
SEQUENCEF:PATIENT9                   0
SEQUENCEF:PATIENT10                  0
SEQUENCEF:PATIENT11   -8.000         0     6.1368 42 -1.3036 0.1994653
SEQUENCEF:PATIENT12                  0
SEQUENCEF:PATIENT13                  0
SEQUENCEF:PATIENT14   -2.000         0     6.1368 42 -0.3259 0.7461154
SEQUENCEF:PATIENT15                  0
SEQUENCEF:PATIENT16                  0
SEQUENCEF:PATIENT17                  0
SEQUENCEF:PATIENT18    0.000         0     0.0000 42
SEQUENCEF:PATIENT19                  0
SEQUENCEF:PATIENT20                  0
SEQUENCEF:PATIENT21                  0
SEQUENCEF:PATIENT22                  0
SEQUENCEF:PATIENT23                  0
SEQUENCEF:PATIENT24                  0
VISIT2                -2.583         0     2.1697 42 -1.1907 0.2404762
VISIT3                 0.750         0     2.1697 42  0.3457 0.7313138
VISIT4                 0.000         0     0.0000 42
DRUGplacebo           -5.938         0     2.4258 42 -2.4477 0.0186398 *
DRUGstandard          -3.625         0     2.4258 42 -1.4944 0.1425553
DRUGtest               0.000         0     0.0000 42
RESIDS                -4.396         1     1.8790 42 -2.3395 0.0241414 *
RESIDT                 0.229         1     1.8790 42  0.1220 0.9035106
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
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

(54) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)     9.49         0    0.46459  9  20.4266 7.537e-09 ***
SOURCEA         0.33         0    0.65703  9   0.5023    0.6275
SOURCEB        -0.02         0    0.65703  9  -0.0304    0.9764
SOURCEC         0.00         0    0.00000  9
AMT             3.35         0    0.14008  9  23.9150 1.867e-09 ***
SOURCEA:AMT    -1.61         0    0.19810  9  -8.1271 1.951e-05 ***
SOURCEB:AMT    -2.00         0    0.19810  9 -10.0958 3.305e-06 ***
SOURCEC:AMT     0.00         0    0.00000  9
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.8.6 p412

(55) MODEL

```r
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 Df t value  Pr(>|t|)
(Intercept)   9.8824   0.136994 16  72.137 < 2.2e-16 ***
```

```
sourceA:amt   1.7230   0.063503 16  27.133 8.438e-15 ***
sourceB:amt   1.2375   0.063503 16  19.488 1.427e-12 ***
sourceC:amt   3.2430   0.063503 16  51.068 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.8.7 p414

(56) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)  1.41347         0   0.155886 20  9.0674 1.598e-08 ***
level        0.00210         0   0.000408 20  5.1443 4.937e-05 ***
```

```
lackofit0   -0.19544         0   0.161770 20 -1.2081  0.241091
lackofit150 -0.34501         0   0.105903 20 -3.2578  0.003939 **
lackofit300  0.00000         0   0.000000 20
lackofit450  0.00000         0   0.000000 20
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.8.8 p417

(57) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)  12.0000         0    0.78365 13 15.3130 1.070e-09 ***
TRT1          0.0000         0    1.91954 13  0.0000   1.00000
```

```
TRT2          8.2500         0    1.17547 13  7.0185 9.087e-06 ***
TRT3          0.0000         0    0.00000 13
TRT1:POT1     2.6667         0    2.02337 13  1.3179   0.21028
TRT1:POT2     6.0000         0    2.14611 13  2.7958   0.01515 *
TRT1:POT3     0.0000         0    0.00000 13
TRT2:POT1     0.2500         0    1.51753 13  0.1647   0.87168
TRT2:POT2     0.0000         0    0.00000 13
TRT2:POT3                    0
TRT3:POT1     1.0000         0    1.27969 13  0.7814   0.44854
TRT3:POT2    -1.0000         0    1.91954 13 -0.5210   0.61115
TRT3:POT3     0.0000         0    0.00000 13
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
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

(58) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)    2.99627         0    0.51285 48  5.8423 4.361e-07 ***
line1          0.07182         0    0.14551 48  0.4936  0.623826
line2          0.25247         0    0.13717 48  1.8406  0.071867 .
line3          0.00000         0    0.00000 48
line1:sire1    0.08573         0    0.13028 48  0.6580  0.513652
line1:sire2   -0.12171         0    0.13622 48 -0.8934  0.376079
line1:sire3    0.00000         0    0.00000 48
line1:sire4                    0
line1:sire5                    0
line1:sire6                    0
line1:sire7                    0
line1:sire8                    0
line1:sire9                    0
line2:sire1                    0
line2:sire2                    0
line2:sire3                    0
```

```
line2:sire4   -0.24460         0    0.12669 48 -1.9307  0.059443 .
line2:sire5    0.00000         0    0.00000 48
line2:sire6                    0
line2:sire7                    0
line2:sire8                    0
line2:sire9                    0
line3:sire1                    0
line3:sire2                    0
line3:sire3                    0
line3:sire4                    0
line3:sire5                    0
line3:sire6    0.10540         0    0.12909 48  0.8165  0.418267
line3:sire7   -0.01952         0    0.12038 48 -0.1622  0.871856
line3:sire8   -0.33024         0    0.12567 48 -2.6278  0.011504 *
line3:sire9    0.00000         0    0.00000 48
agedam3        0.37039         0    0.11456 48  3.2332  0.002216 **
agedam4        0.27546         0    0.10378 48  2.6544  0.010746 *
agedam5        0.00000         0    0.00000 48
line1:agedam3 -0.44894         0    0.19581 48 -2.2927  0.026291 *
line1:agedam4 -0.28283         0    0.16085 48 -1.7584  0.085062 .
line1:agedam5  0.00000         0    0.00000 48
line2:agedam3 -0.26078         0    0.19529 48 -1.3354  0.188050
line2:agedam4 -0.35026         0    0.17439 48 -2.0085  0.050232 .
line2:agedam5  0.00000         0    0.00000 48
line3:agedam3  0.00000         0    0.00000 48
line3:agedam4  0.00000         0    0.00000 48
line3:agedam5  0.00000         0    0.00000 48
age           -0.00853         1    0.00310 48 -2.7546  0.008277 **
intlwt         0.00203         1    0.00087 48  2.3168  0.024830 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
# p433 Output 11.40
```

```r
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
```

(59) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)  2.46347         0   0.096216 54 25.6036  < 2e-16 ***
sire1       -0.00739         0   0.128186 54 -0.0576  0.95427
sire2       -0.21429         0   0.128606 54 -1.6662  0.10146
sire3       -0.02260         0   0.146050 54 -0.1548  0.87759
sire4       -0.02364         0   0.128186 54 -0.1844  0.85440
sire5        0.12311         0   0.132193 54  0.9313  0.35585
sire6       -0.05290         0   0.138320 54 -0.3824  0.70364
```

```
sire7       -0.14760         0   0.129061 54 -1.1436  0.25782
sire8       -0.40781         0   0.135054 54 -3.0196  0.00386 **
sire9        0.00000         0   0.000000 54
agedam3      0.11738         0   0.089117 54  1.3172  0.19334
agedam4      0.04830         0   0.077154 54  0.6260  0.53395
agedam5      0.00000         0   0.000000 54
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

5.8.10 p437 ABSORB option in SAS

(60) 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 .
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)    2.99627         0    0.51285 48  5.8423 4.361e-07 ***
line1          0.07182         0    0.14551 48  0.4936  0.623826
line2          0.25247         0    0.13717 48  1.8406  0.071867 .
line3          0.00000         0    0.00000 48
sire1          0.08573         0    0.13028 48  0.6580  0.513652
sire2         -0.12171         0    0.13622 48 -0.8934  0.376079
sire3          0.00000         0    0.00000 48
sire4         -0.24460         0    0.12669 48 -1.9307  0.059443 .
sire5          0.00000         0    0.00000 48
sire6          0.10540         0    0.12909 48  0.8165  0.418267
sire7         -0.01952         0    0.12038 48 -0.1622  0.871856
sire8         -0.33024         0    0.12567 48 -2.6278  0.011504 *
sire9          0.00000         0    0.00000 48
agedam3        0.37039         0    0.11456 48  3.2332  0.002216 **
agedam4        0.27546         0    0.10378 48  2.6544  0.010746 *
agedam5        0.00000         0    0.00000 48
line1:agedam3 -0.44894         0    0.19581 48 -2.2927  0.026291 *
line1:agedam4 -0.28283         0    0.16085 48 -1.7584  0.085062 .
line1:agedam5  0.00000         0    0.00000 48
line2:agedam3 -0.26078         0    0.19529 48 -1.3354  0.188050
line2:agedam4 -0.35026         0    0.17439 48 -2.0085  0.050232 .
line2:agedam5  0.00000         0    0.00000 48
line3:agedam3  0.00000         0    0.00000 48
line3:agedam4  0.00000         0    0.00000 48
line3:agedam5  0.00000         0    0.00000 48
age           -0.00853         1    0.00310 48 -2.7546  0.008277 **
intlwt         0.00203         1    0.00087 48  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

(61) 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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)   66.133         0    0.47304 59 139.8040 < 2.2e-16 ***
Group1        -2.952         0    0.72726 59  -4.0584 0.0001473 ***
Group2        -2.508         0    0.80208 59  -3.1273 0.0027390 **
Group3        -1.967         0    0.88498 59  -2.2223 0.0301120 *
Group4        -2.592         0    0.60301 59  -4.2979 6.547e-05 ***
```

```
Group5         0.000         0    0.00000 59
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

6.2 Table 12.6

(62) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)  0.42999         0   0.079313 45  5.4214 2.236e-06 ***
Location1    0.27409         0   0.066143 45  4.1438 0.0001487 ***
Location2    0.07118         0   0.065245 45  1.0910 0.2810986
Location3   -0.06869         0   0.061950 45 -1.1088 0.2734048
```

```
Location4    0.00000         0   0.000000 45
Family1      0.18733         0   0.077778 45  2.4085 0.0201753 *
Family2     -0.02753         0   0.079595 45 -0.3458 0.7310768
Family3      0.31264         0   0.079951 45  3.9103 0.0003080 ***
Family4      0.14331         0   0.093203 45  1.5376 0.1311397
Family5      0.00000         0   0.000000 45
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

6.3 Table 13.6

(63) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)     78.560         0    0.89256 35 88.0168 < 2.2e-16 ***
Site1            6.340         0    1.26227 35  5.0227 1.498e-05 ***
Site2            2.460         0    1.26227 35  1.9489  0.059362 .
Site3            0.000         0    0.00000 35
Worker1          3.640         0    1.45754 35  2.4974  0.017365 *
Worker2          3.840         0    1.26227 35  3.0421  0.004433 **
Worker3         15.565         0    1.33883 35 11.6258 1.430e-13 ***
Worker4          0.000         0    0.00000 35
Site1:Worker1   -5.940         0    2.62762 35 -2.2606  0.030108 *
Site1:Worker2    9.720         0    1.78511 35  5.4450 4.165e-06 ***
Site1:Worker3   -9.690         0    1.89340 35 -5.1178 1.124e-05 ***
Site1:Worker4    0.000         0    0.00000 35
Site2:Worker1  -11.960         0    2.62762 35 -4.5517 6.165e-05 ***
Site2:Worker2  -12.960         0    1.84005 35 -7.0433 3.360e-08 ***
Site2:Worker3  -16.365         0    1.84005 35 -8.8938 1.660e-10 ***
Site2:Worker4    0.000         0    0.00000 35
Site3:Worker1    0.000         0    0.00000 35
Site3:Worker2    0.000         0    0.00000 35
Site3:Worker3    0.000         0    0.00000 35
Site3:Worker4    0.000         0    0.00000 35
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

6.4 Table 14.2

(64) MODEL

```r
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 Estimable Std. Error  Df t value  Pr(>|t|)
(Intercept)  194.520         0     2.8292 110 68.7541 < 2.2e-16 ***
Day1          -1.395         0     2.5210 110 -0.5535    0.5811
Day2         -12.591         0     2.4293 110 -5.1831 9.994e-07 ***
Day3           0.000         0     0.0000 110
Machine1      10.446         0     2.4410 110  4.2795 4.015e-05 ***
Machine2       1.301         0     2.3888 110  0.5447    0.5871
Machine3       0.000         0     0.0000 110
Operator1     -3.048         0     2.8546 110 -1.0677    0.2880
Operator2     -0.076         0     2.6570 110 -0.0287    0.9771
Operator3     -0.275         0     2.7474 110 -0.0999    0.9206
Operator4      0.000         0     0.0000 110
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

6.5 Table 15.3

(65) MODEL

```r
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 Estimable Std. Error  Df  t value  Pr(>|t|)
(Intercept)   7.5020         0   0.022242 123 337.2849 < 2.2e-16 ***
Dam1         -0.0445         0   0.033363 123  -1.3338 0.1847360
Dam2         -0.0670         0   0.033363 123  -2.0082 0.0468144 *
Dam3         -0.0600         0   0.031455 123  -1.9075 0.0587923 .
Dam4         -0.1170         0   0.033363 123  -3.5068 0.0006338 ***
Dam5          0.0513         0   0.036322 123   1.4133 0.1600927
Dam6         -0.0420         0   0.031455 123  -1.3352 0.1842689
Dam7         -0.0580         0   0.031455 123  -1.8439 0.0676071 .
Dam8         -0.0440         0   0.031455 123  -1.3988 0.1643876
Dam9         -0.0895         0   0.033363 123  -2.6826 0.0083104 **
Dam10        -0.0545         0   0.033363 123  -1.6335 0.1049163
Dam11        -0.0140         0   0.031455 123  -0.4451 0.6570480
Dam12        -0.0870         0   0.033363 123  -2.6076 0.0102452 *
Dam13        -0.0495         0   0.033363 123  -1.4837 0.1404576
Dam14        -0.0340         0   0.031455 123  -1.0809 0.2818582
Dam15         0.0000         0   0.000000 123
Dam1:Sire1    0.0475         0   0.035168 123   1.3507 0.1792866
Dam1:Sire2    0.0000         0   0.000000 123
Dam1:Sire3                   0
Dam2:Sire1   -0.0010         0   0.033363 123  -0.0300 0.9761373
```

```
Dam2:Sire2    0.0000         0   0.000000 123
Dam2:Sire3                   0
Dam3:Sire1   -0.0045         0   0.033363 123  -0.1349 0.8929288
Dam3:Sire2   -0.0320         0   0.033363 123  -0.9591 0.3393736
Dam3:Sire3    0.0000         0   0.000000 123
Dam4:Sire1    0.0550         0   0.037986 123   1.4479 0.1501886
Dam4:Sire2    0.0000         0   0.000000 123
Dam4:Sire3                   0
Dam5:Sire1   -0.0593         0   0.036322 123  -1.6336 0.1049091
Dam5:Sire2   -0.0608         0   0.037986 123  -1.6015 0.1118387
Dam5:Sire3    0.0000         0   0.000000 123
Dam6:Sire1   -0.0450         0   0.033363 123  -1.3488 0.1798857
Dam6:Sire2    0.0075         0   0.033363 123   0.2248 0.8225105
Dam6:Sire3    0.0000         0   0.000000 123
Dam7:Sire1   -0.0290         0   0.033363 123  -0.8692 0.3864232
Dam7:Sire2   -0.0340         0   0.031455 123  -1.0809 0.2818582
Dam7:Sire3    0.0000         0   0.000000 123
Dam8:Sire1    0.0520         0   0.036322 123   1.4317 0.1547783
Dam8:Sire2    0.0000         0   0.000000 123
Dam8:Sire3                   0
Dam9:Sire1   -0.0225         0   0.035168 123  -0.6398 0.5235039
Dam9:Sire2    0.0000         0   0.000000 123
Dam9:Sire3                   0
Dam10:Sire1  -0.0695         0   0.033363 123  -2.0831 0.0393121 *
Dam10:Sire2   0.0000         0   0.000000 123
Dam10:Sire3                  0
Dam11:Sire1   0.0460         0   0.031455 123   1.4624 0.1461852
Dam11:Sire2   0.0000         0   0.000000 123
Dam11:Sire3                  0
Dam12:Sire1   0.0470         0   0.033363 123   1.4087 0.1614391
Dam12:Sire2   0.0000         0   0.000000 123
Dam12:Sire3                  0
Dam13:Sire1  -0.0645         0   0.033363 123  -1.9333 0.0555032 .
Dam13:Sire2  -0.0358         0   0.037986 123  -0.9433 0.3473613
Dam13:Sire3   0.0000         0   0.000000 123
Dam14:Sire1   0.0245         0   0.033363 123   0.7343 0.4641417
Dam14:Sire2  -0.0180         0   0.033363 123  -0.5395 0.5905089
Dam14:Sire3   0.0000         0   0.000000 123
Dam15:Sire1  -0.0500         0   0.031455 123  -1.5896 0.1145028
Dam15:Sire2  -0.0580         0   0.031455 123  -1.8439 0.0676071 .
Dam15:Sire3   0.0000         0   0.000000 123
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
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

(66) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)                 0.390         0    0.10019 22  3.8925 0.0007836 ***
Plot1                       0.130         0    0.14169 22  0.9175 0.3688465
Plot2                       0.690         0    0.14169 22  4.8696 7.227e-05 ***
Plot3                      -0.100         0    0.14169 22 -0.7057 0.4877535
Plot4                      -0.290         0    0.14169 22 -2.0467 0.0528230 .
Plot5                       0.530         0    0.14169 22  3.7404 0.0011335 **
Plot6                       0.020         0    0.14169 22  0.1411 0.8890368
Plot7                       0.050         0    0.14169 22  0.3529 0.7275426
Plot8                      -0.030         0    0.14169 22 -0.2117 0.8342720
Plot9                       0.530         0    0.14169 22  3.7404 0.0011335 **
Plot10                      0.130         0    0.14169 22  0.9175 0.3688465
Plot11                      0.000         0    0.00000 22
Plot1:Sample1              -0.060         0    0.12271 22 -0.4890 0.6297131
Plot1:Sample2               0.020         0    0.14169 22  0.1411 0.8890368
Plot1:Sample3               0.000         0    0.00000 22
Plot2:Sample1              -0.595         0    0.12271 22 -4.8488 7.603e-05 ***
Plot2:Sample2              -0.650         0    0.14169 22 -4.5873 0.0001437 ***
Plot2:Sample3               0.000         0    0.00000 22
Plot3:Sample1               0.095         0    0.12271 22  0.7742 0.4470663
Plot3:Sample2               0.090         0    0.14169 22  0.6352 0.5318688
Plot3:Sample3               0.000         0    0.00000 22
Plot4:Sample1               0.200         0    0.12271 22  1.6298 0.1173694
Plot4:Sample2               0.150         0    0.14169 22  1.0586 0.3012597
Plot4:Sample3               0.000         0    0.00000 22
Plot5:Sample1              -0.365         0    0.12271 22 -2.9745 0.0069960 **
Plot5:Sample2              -0.080         0    0.14169 22 -0.5646 0.5780606
Plot5:Sample3               0.000         0    0.00000 22
Plot6:Sample1               0.065         0    0.12271 22  0.5297 0.6016249
Plot6:Sample2              -0.150         0    0.14169 22 -1.0586 0.3012597
Plot6:Sample3               0.000         0    0.00000 22
Plot7:Sample1               0.115         0    0.12271 22  0.9372 0.3588500
Plot7:Sample2               0.060         0    0.14169 22  0.4234 0.6760804
Plot7:Sample3               0.000         0    0.00000 22
Plot8:Sample1               0.305         0    0.12271 22  2.4855 0.0210209 *
Plot8:Sample2               0.180         0    0.14169 22  1.2703 0.2172344
Plot8:Sample3               0.000         0    0.00000 22
Plot9:Sample1              -0.355         0    0.12271 22 -2.8930 0.0084403 **
Plot9:Sample2              -0.210         0    0.14169 22 -1.4821 0.1525064
Plot9:Sample3               0.000         0    0.00000 22
Plot10:Sample1             -0.020         0    0.12271 22 -0.1630 0.8720183
Plot10:Sample2              0.000         0    0.14169 22  0.0000 1.0000000
```

Plot10:Sample3	0.000	0	0.00000	22			
Plot11:Sample1	0.000	0	0.12271	22	0.0000	1.0000000	
Plot11:Sample2	0.110	0	0.14169	22	0.7763	0.4458271	
Plot11:Sample3	0.000	0	0.00000	22			
Plot1:Sample1:Subsample1	0.015	0	0.10019	22	0.1497	0.8823566	
Plot1:Sample1:Subsample2	0.000	0	0.00000	22			
Plot1:Sample2:Subsample1	-0.280	0	0.14169	22	-1.9761	0.0608176	.
Plot1:Sample2:Subsample2	0.000	0	0.00000	22			
Plot1:Sample3:Subsample1	0.000	0	0.00000	22			
Plot1:Sample3:Subsample2		0					
Plot2:Sample1:Subsample1	0.060	0	0.10019	22	0.5988	0.5553935	
Plot2:Sample1:Subsample2	0.000	0	0.00000	22			
Plot2:Sample2:Subsample1	-0.390	0	0.14169	22	-2.7524	0.0116232	*
Plot2:Sample2:Subsample2	0.000	0	0.00000	22			
Plot2:Sample3:Subsample1	0.000	0	0.00000	22			
Plot2:Sample3:Subsample2		0					
Plot3:Sample1:Subsample1	-0.085	0	0.10019	22	-0.8484	0.4053723	
Plot3:Sample1:Subsample2	0.000	0	0.00000	22			
Plot3:Sample2:Subsample1	-0.130	0	0.14169	22	-0.9175	0.3688465	
Plot3:Sample2:Subsample2	0.000	0	0.00000	22			
Plot3:Sample3:Subsample1	0.000	0	0.00000	22			
Plot3:Sample3:Subsample2		0					
Plot4:Sample1:Subsample1	-0.090	0	0.10019	22	-0.8983	0.3787697	
Plot4:Sample1:Subsample2	0.000	0	0.00000	22			
Plot4:Sample2:Subsample1	-0.120	0	0.14169	22	-0.8469	0.4061732	
Plot4:Sample2:Subsample2	0.000	0	0.00000	22			
Plot4:Sample3:Subsample1	0.000	0	0.00000	22			
Plot4:Sample3:Subsample2		0					
Plot5:Sample1:Subsample1	0.300	0	0.10019	22	2.9942	0.0066835	**
Plot5:Sample1:Subsample2	0.000	0	0.00000	22			
Plot5:Sample2:Subsample1	0.110	0	0.14169	22	0.7763	0.4458271	
Plot5:Sample2:Subsample2	0.000	0	0.00000	22			
Plot5:Sample3:Subsample1	0.000	0	0.00000	22			
Plot5:Sample3:Subsample2		0					
Plot6:Sample1:Subsample1	0.115	0	0.10019	22	1.1478	0.2633860	
Plot6:Sample1:Subsample2	0.000	0	0.00000	22			
Plot6:Sample2:Subsample1	0.070	0	0.14169	22	0.4940	0.6261876	
Plot6:Sample2:Subsample2	0.000	0	0.00000	22			
Plot6:Sample3:Subsample1	0.000	0	0.00000	22			
Plot6:Sample3:Subsample2		0					
Plot7:Sample1:Subsample1	0.110	0	0.10019	22	1.0979	0.2841276	
Plot7:Sample1:Subsample2	0.000	0	0.00000	22			
Plot7:Sample2:Subsample1	-0.060	0	0.14169	22	-0.4234	0.6760804	
Plot7:Sample2:Subsample2	0.000	0	0.00000	22			
Plot7:Sample3:Subsample1	0.000	0	0.00000	22			
Plot7:Sample3:Subsample2		0					
Plot8:Sample1:Subsample1	0.240	0	0.10019	22	2.3954	0.0255487	*
Plot8:Sample1:Subsample2	0.000	0	0.00000	22			

```
Plot8:Sample2:Subsample1     0.100         0    0.14169 22  0.7057 0.4877535
Plot8:Sample2:Subsample2     0.000         0    0.00000 22
Plot8:Sample3:Subsample1     0.000         0    0.00000 22
Plot8:Sample3:Subsample2                   0
Plot9:Sample1:Subsample1     0.020         0    0.10019 22  0.1996 0.8436154
Plot9:Sample1:Subsample2     0.000         0    0.00000 22
Plot9:Sample2:Subsample1    -0.110         0    0.14169 22 -0.7763 0.4458271
Plot9:Sample2:Subsample2     0.000         0    0.00000 22
Plot9:Sample3:Subsample1     0.000         0    0.00000 22
Plot9:Sample3:Subsample2                   0
Plot10:Sample1:Subsample1    0.050         0    0.10019 22  0.4990 0.6227069
Plot10:Sample1:Subsample2    0.000         0    0.00000 22
Plot10:Sample2:Subsample1   -0.060         0    0.14169 22 -0.4234 0.6760804
Plot10:Sample2:Subsample2    0.000         0    0.00000 22
Plot10:Sample3:Subsample1    0.000         0    0.00000 22
Plot10:Sample3:Subsample2                   0
Plot11:Sample1:Subsample1   -0.090         0    0.10019 22 -0.8983 0.3787697
Plot11:Sample1:Subsample2    0.000         0    0.00000 22
Plot11:Sample2:Subsample1    0.030         0    0.14169 22  0.2117 0.8342720
Plot11:Sample2:Subsample2    0.000         0    0.00000 22
Plot11:Sample3:Subsample1    0.000         0    0.00000 22
Plot11:Sample3:Subsample2                   0
---
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
```

```r
# 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

(67) 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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   66.700         0     2.7193 36 24.5282 < 2.2e-16 ***
R1             6.750         0     2.9071 36  2.3219  0.026009 *
R2            10.025         0     2.9071 36  3.4485  0.001453 **
R3             5.825         0     2.9071 36  2.0037  0.052669 .
R4             0.000         0     0.0000 36
A1             6.856         0     3.8457 36  1.7828  0.083048 .
A2            -4.212         0     3.8457 36 -1.0954  0.280625
A3             2.231         0     3.8457 36  0.5802  0.565398
A4             0.000         0     0.0000 36
R1:A1         -4.050         0     4.1112 36 -0.9851  0.331146
R1:A2         -3.375         0     4.1112 36 -0.8209  0.417093
R1:A3         -3.800         0     4.1112 36 -0.9243  0.361485
R1:A4          0.000         0     0.0000 36
R2:A1        -11.325         0     4.1112 36 -2.7547  0.009156 **
R2:A2         -5.150         0     4.1112 36 -1.2527  0.218403
R2:A3         -6.475         0     4.1112 36 -1.5750  0.124015
R2:A4          0.000         0     0.0000 36
R3:A1         -7.550         0     4.1112 36 -1.8364  0.074562 .
R3:A2         -5.625         0     4.1112 36 -1.3682  0.179727
R3:A3         -6.650         0     4.1112 36 -1.6175  0.114496
R3:A4          0.000         0     0.0000 36
R4:A1          0.000         0     0.0000 36
R4:A2          0.000         0     0.0000 36
R4:A3          0.000         0     0.0000 36
R4:A4          0.000         0     0.0000 36
B1            -1.800         0     2.9071 36 -0.6192  0.539698
B2           -17.100         0     2.9071 36 -5.8822 9.985e-07 ***
B3            -1.000         0     2.9071 36 -0.3440  0.732856
B4             0.000         0     0.0000 36
A1:B1          3.700         0     4.1112 36  0.9000  0.374115
A1:B2         -4.275         0     4.1112 36 -1.0398  0.305350
A1:B3         -0.250         0     4.1112 36 -0.0608  0.951848
A1:B4          0.000         0     0.0000 36
A2:B1          9.500         0     4.1112 36  2.3107  0.026687 *
A2:B2          3.850         0     4.1112 36  0.9365  0.355276
A2:B3          4.400         0     4.1112 36  1.0702  0.291635
A2:B4          0.000         0     0.0000 36
A3:B1         -1.225         0     4.1112 36 -0.2980  0.767443
A3:B2         -2.800         0     4.1112 36 -0.6811  0.500190
A3:B3          1.900         0     4.1112 36  0.4621  0.646755
A3:B4          0.000         0     0.0000 36
```

```
A4:B1          0.000         0     0.0000 36
A4:B2          0.000         0     0.0000 36
A4:B3          0.000         0     0.0000 36
A4:B4          0.000         0     0.0000 36
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.2 Example 1.2

(68) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   16.000         0     3.4804 48  4.5972 3.130e-05 ***
R1            -6.250         0     3.4804 48 -1.7958 0.0788230 .
R2            -5.750         0     3.4804 48 -1.6521 0.1050354
R3             0.000         0     0.0000 48
A0            -7.083         0     4.9220 48 -1.4391 0.1566037
A1            -4.000         0     4.9220 48 -0.8127 0.4204117
A2            -4.500         0     4.9220 48 -0.9143 0.3651450
A3            -6.333         0     4.9220 48 -1.2868 0.2043526
A4            -3.500         0     4.9220 48 -0.7111 0.4804644
A5            -1.667         0     4.9220 48 -0.3386 0.7363740
A6            -6.250         0     4.9220 48 -1.2698 0.2102707
A7             0.000         0     0.0000 48
R1:A0          5.250         0     4.9220 48  1.0666 0.2914665
R1:A1         15.000         0     4.9220 48  3.0476 0.0037444 **
R1:A2         -0.500         0     4.9220 48 -0.1016 0.9195088
R1:A3          7.250         0     4.9220 48  1.4730 0.1472813
R1:A4          5.000         0     4.9220 48  1.0159 0.3147916
R1:A5          8.000         0     4.9220 48  1.6254 0.1106329
R1:A6         10.500         0     4.9220 48  2.1333 0.0380399 *
R1:A7          0.000         0     0.0000 48
R2:A0          5.000         0     4.9220 48  1.0159 0.3147916
R2:A1         -5.000         0     4.9220 48 -1.0159 0.3147916
R2:A2         12.000         0     4.9220 48  2.4381 0.0185190 *
R2:A3          4.750         0     4.9220 48  0.9651 0.3393506
R2:A4          4.500         0     4.9220 48  0.9143 0.3651450
R2:A5         12.000         0     4.9220 48  2.4381 0.0185190 *
R2:A6          2.250         0     4.9220 48  0.4571 0.6496363
R2:A7          0.000         0     0.0000 48
R3:A0          0.000         0     0.0000 48
R3:A1          0.000         0     0.0000 48
R3:A2          0.000         0     0.0000 48
R3:A3          0.000         0     0.0000 48
R3:A4          0.000         0     0.0000 48
R3:A5          0.000         0     0.0000 48
R3:A6          0.000         0     0.0000 48
R3:A7          0.000         0     0.0000 48
B0            36.000         0     4.0188 48  8.9580 8.177e-12 ***
B1             7.667         0     4.0188 48  1.9077 0.0624200 .
B2            19.333         0     4.0188 48  4.8108 1.531e-05 ***
B3             0.000         0     0.0000 48
A0:B0         22.000         0     5.6834 48  3.8709 0.0003271 ***
```

```
A0:B1          -4.333          0      5.6834 48 -0.7625 0.4495188
A0:B2         -15.333          0      5.6834 48 -2.6979 0.0096001 **
A0:B3           0.000          0      0.0000 48
A1:B0          16.000          0      5.6834 48  2.8152 0.0070497 **
A1:B1          -0.667          0      5.6834 48 -0.1173 0.9071111
A1:B2         -16.333          0      5.6834 48 -2.8739 0.0060246 **
A1:B3           0.000          0      0.0000 48
A2:B0          17.667          0      5.6834 48  3.1085 0.0031582 **
A2:B1          -6.333          0      5.6834 48 -1.1144 0.2706743
A2:B2          -4.333          0      5.6834 48 -0.7625 0.4495188
A2:B3           0.000          0      0.0000 48
A3:B0           4.667          0      5.6834 48  0.8211 0.4156454
A3:B1          -7.333          0      5.6834 48 -1.2903 0.2031245
A3:B2         -15.000          0      5.6834 48 -2.6393 0.0111717 *
A3:B3           0.000          0      0.0000 48
A4:B0           1.667          0      5.6834 48  0.2933 0.7705935
A4:B1          -3.000          0      5.6834 48 -0.5279 0.6000325
A4:B2         -20.667          0      5.6834 48 -3.6363 0.0006736 ***
A4:B3           0.000          0      0.0000 48
A5:B0           5.000          0      5.6834 48  0.8798 0.3833746
A5:B1         -16.667          0      5.6834 48 -2.9325 0.0051395 **
A5:B2          -6.667          0      5.6834 48 -1.1730 0.2465806
A5:B3           0.000          0      0.0000 48
A6:B0           0.333          0      5.6834 48  0.0587 0.9534740
A6:B1          -3.000          0      5.6834 48 -0.5279 0.6000325
A6:B2          -7.333          0      5.6834 48 -1.2903 0.2031245
A6:B3           0.000          0      0.0000 48
A7:B0           0.000          0      0.0000 48
A7:B1           0.000          0      0.0000 48
A7:B2           0.000          0      0.0000 48
A7:B3           0.000          0      0.0000 48
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.3 Example 2.1

(69) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   46.583         0    0.95462 18 48.7979 < 2.2e-16 ***
R1             0.833         0    1.02053 18  0.8166  0.424850
R2             0.000         0    0.00000 18
A0            -3.833         0    1.31750 18 -2.9096  0.009350 **
A1             2.667         0    1.31750 18  2.0240  0.058068 .
A2             1.000         0    1.31750 18  0.7590  0.457669
A3            -2.167         0    1.31750 18 -1.6445  0.117418
A4             1.000         0    1.31750 18  0.7590  0.457669
A5            -1.333         0    1.31750 18 -1.0120  0.324940
A6             1.500         0    1.31750 18  1.1385  0.269830
```

A7	4.500	0	1.31750	18	3.4156	0.003083	**
A8	-0.167	0	1.31750	18	-0.1265	0.900737	
A9	0.000	0	0.00000	18			
R1:A0	1.667	0	1.31750	18	1.2650	0.221996	
R1:A1	-3.333	0	1.31750	18	-2.5300	0.020955	*
R1:A2	-4.000	0	1.31750	18	-3.0361	0.007105	**
R1:A3	0.333	0	1.31750	18	0.2530	0.803131	
R1:A4	0.000	0	1.31750	18	0.0000	1.000000	
R1:A5	2.667	0	1.31750	18	2.0240	0.058068	.
R1:A6	-4.000	0	1.31750	18	-3.0361	0.007105	**
R1:A7	-3.000	0	1.31750	18	-2.2770	0.035225	*
R1:A8	-2.667	0	1.31750	18	-2.0240	0.058068	.
R1:A9	0.000	0	0.00000	18			
R2:A0	0.000	0	0.00000	18			
R2:A1	0.000	0	0.00000	18			
R2:A2	0.000	0	0.00000	18			
R2:A3	0.000	0	0.00000	18			
R2:A4	0.000	0	0.00000	18			
R2:A5	0.000	0	0.00000	18			
R2:A6	0.000	0	0.00000	18			
R2:A7	0.000	0	0.00000	18			
R2:A8	0.000	0	0.00000	18			
R2:A9	0.000	0	0.00000	18			
B1	-3.150	0	1.19668	18	-2.6323	0.016910	*
B2	-0.600	0	1.19668	18	-0.5014	0.622175	
B3	0.000	0	0.00000	18			
R1:B1	2.300	0	0.72162	18	3.1873	0.005103	**
R1:B2	0.200	0	0.72162	18	0.2772	0.784821	
R1:B3	0.000	0	0.00000	18			
R2:B1	0.000	0	0.00000	18			
R2:B2	0.000	0	0.00000	18			
R2:B3	0.000	0	0.00000	18			
A0:B1	3.000	0	1.61360	18	1.8592	0.079426	.
A0:B2	0.500	0	1.61360	18	0.3099	0.760221	
A0:B3	0.000	0	0.00000	18			
A1:B1	-3.000	0	1.61360	18	-1.8592	0.079426	.
A1:B2	-4.000	0	1.61360	18	-2.4789	0.023305	*
A1:B3	0.000	0	0.00000	18			
A2:B1	2.500	0	1.61360	18	1.5493	0.138705	
A2:B2	-2.500	0	1.61360	18	-1.5493	0.138705	
A2:B3	0.000	0	0.00000	18			
A3:B1	2.000	0	1.61360	18	1.2395	0.231091	
A3:B2	-0.500	0	1.61360	18	-0.3099	0.760221	
A3:B3	0.000	0	0.00000	18			
A4:B1	-2.000	0	1.61360	18	-1.2395	0.231091	
A4:B2	-1.000	0	1.61360	18	-0.6197	0.543200	
A4:B3	0.000	0	0.00000	18			
A5:B1	1.000	0	1.61360	18	0.6197	0.543200	

```
A5:B2          0.000         0    1.61360 18  0.0000  1.000000
A5:B3          0.000         0    0.00000 18
A6:B1         -1.000         0    1.61360 18 -0.6197  0.543200
A6:B2         -0.500         0    1.61360 18 -0.3099  0.760221
A6:B3          0.000         0    0.00000 18
A7:B1         -0.500         0    1.61360 18 -0.3099  0.760221
A7:B2         -2.000         0    1.61360 18 -1.2395  0.231091
A7:B3          0.000         0    0.00000 18
A8:B1          2.500         0    1.61360 18  1.5493  0.138705
A8:B2         -2.000         0    1.61360 18 -1.2395  0.231091
A8:B3          0.000         0    0.00000 18
A9:B1          0.000         0    0.00000 18
A9:B2          0.000         0    0.00000 18
A9:B3          0.000         0    0.00000 18
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.4 Example 2.2

(70) 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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)  1000.52         0     11.393 48 87.8167  < 2e-16 ***
Column1        12.04         0     14.132 48  0.8522  0.39836
Column2        10.64         0     14.132 48  0.7529  0.45520
Column3         0.98         0     14.132 48  0.0696  0.94478
Column4       -12.93         0     14.132 48 -0.9149  0.36480
Column5         0.00         0      0.000 48
R1            -13.81         0     14.132 48 -0.9774  0.33325
R2            -10.85         0     14.132 48 -0.7678  0.44636
R3             -2.17         0     14.132 48 -0.1533  0.87880
R4             -3.63         0     14.132 48 -0.2571  0.79819
R5              0.00         0      0.000 48
Column1:R1     16.78         0     15.800 48  1.0619  0.29360
Column1:R2      5.34         0     15.800 48  0.3383  0.73661
Column1:R3     -9.13         0     15.800 48 -0.5775  0.56627
Column1:R4     -6.31         0     15.800 48 -0.3994  0.69139
Column1:R5      0.00         0      0.000 48
Column2:R1     16.71         0     15.800 48  1.0578  0.29545
Column2:R2     -1.64         0     15.800 48 -0.1036  0.91789
Column2:R3      7.40         0     15.800 48  0.4687  0.64142
Column2:R4     11.71         0     15.800 48  0.7413  0.46212
Column2:R5      0.00         0      0.000 48
Column3:R1     12.12         0     15.800 48  0.7671  0.44678
Column3:R2      0.27         0     15.800 48  0.0169  0.98656
Column3:R3    -14.04         0     15.800 48 -0.8885  0.37872
Column3:R4      9.01         0     15.800 48  0.5703  0.57116
Column3:R5      0.00         0      0.000 48
Column4:R1      1.31         0     15.800 48  0.0832  0.93402
Column4:R2     -3.85         0     15.800 48 -0.2438  0.80840
Column4:R3      0.84         0     15.800 48  0.0532  0.95782
Column4:R4      9.65         0     15.800 48  0.6111  0.54402
Column4:R5      0.00         0      0.000 48
Column5:R1      0.00         0      0.000 48
Column5:R2      0.00         0      0.000 48
Column5:R3      0.00         0      0.000 48
Column5:R4      0.00         0      0.000 48
Column5:R5      0.00         0      0.000 48
```

```
S1              3.74         0     13.406 48  0.2789  0.78154
S2             12.15         0     13.406 48  0.9066  0.36916
S3              2.83         0     13.406 48  0.2110  0.83380
S4              0.00         0      0.000 48
Column1:S1    -15.16         0     14.132 48 -1.0730  0.28861
Column1:S2    -31.48         0     14.132 48 -2.2278  0.03062 *
Column1:S3      1.26         0     14.132 48  0.0889  0.92955
Column1:S4      0.00         0      0.000 48
Column2:S1    -22.54         0     14.132 48 -1.5947  0.11734
Column2:S2    -31.01         0     14.132 48 -2.1946  0.03306 *
Column2:S3     -3.56         0     14.132 48 -0.2518  0.80229
Column2:S4      0.00         0      0.000 48
Column3:S1     -1.71         0     14.132 48 -0.1207  0.90442
Column3:S2    -14.46         0     14.132 48 -1.0229  0.31146
Column3:S3     19.65         0     14.132 48  1.3902  0.17088
Column3:S4      0.00         0      0.000 48
Column4:S1      5.39         0     14.132 48  0.3816  0.70448
Column4:S2     -3.36         0     14.132 48 -0.2376  0.81319
Column4:S3     17.58         0     14.132 48  1.2443  0.21943
Column4:S4      0.00         0      0.000 48
Column5:S1      0.00         0      0.000 48
Column5:S2      0.00         0      0.000 48
Column5:S3      0.00         0      0.000 48
Column5:S4      0.00         0      0.000 48
R1:S1           3.84         0     14.132 48  0.2714  0.78721
R1:S2          -1.62         0     14.132 48 -0.1148  0.90910
R1:S3         -11.37         0     14.132 48 -0.8047  0.42495
R1:S4           0.00         0      0.000 48
R2:S1          12.02         0     14.132 48  0.8507  0.39915
R2:S2          10.32         0     14.132 48  0.7300  0.46894
R2:S3          -6.46         0     14.132 48 -0.4568  0.64984
R2:S4           0.00         0      0.000 48
R3:S1           9.62         0     14.132 48  0.6810  0.49913
R3:S2           2.19         0     14.132 48  0.1551  0.87738
R3:S3          -8.14         0     14.132 48 -0.5760  0.56730
R3:S4           0.00         0      0.000 48
R4:S1           4.15         0     14.132 48  0.2939  0.77006
R4:S2           3.09         0     14.132 48  0.2189  0.82762
R4:S3          -6.44         0     14.132 48 -0.4560  0.65045
R4:S4           0.00         0      0.000 48
R5:S1           0.00         0      0.000 48
R5:S2           0.00         0      0.000 48
R5:S3           0.00         0      0.000 48
R5:S4           0.00         0      0.000 48
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(71) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)    1001.61         0             0
Row1             -5.98         0             0
Row2             16.88         0             0
Row3             19.34         0             0
Row4            -24.93         0             0
```

Row5	0.00	0	0
R1	9.12	0	0
R2	-18.93	0	0
R3	-2.75	0	0
R4	3.02	0	0
R5	0.00	0	0
Row1:R1	3.72	0	0
Row1:R2	14.16	0	0
Row1:R3	-24.63	0	0
Row1:R4	3.52	0	0
Row1:R5	0.00	0	0
Row2:R1	-61.81	0	0
Row2:R2	12.43	0	0
Row2:R3	-0.94	0	0
Row2:R4	-20.79	0	0
Row2:R5	0.00	0	0
Row3:R1	-56.60	0	0
Row3:R2	-12.11	0	0
Row3:R3	-30.06	0	0
Row3:R4	-4.44	0	0
Row3:R5	0.00	0	0
Row4:R1	46.95	0	0
Row4:R2	26.04	0	0
Row4:R3	43.63	0	0
Row4:R4	12.51	0	0
Row4:R5	0.00	0	0
Row5:R1	0.00	0	0
Row5:R2	0.00	0	0
Row5:R3	0.00	0	0
Row5:R4	0.00	0	0
Row5:R5	0.00	0	0
S1	24.26	0	0
S2	21.85	0	0
S3	-7.81	0	0
S4	0.00	0	0
S1:Column1	-47.84	0	0
S1:Column2	-58.48	0	0
S1:Column3	-40.38	0	0
S1:Column4	10.08	0	0
S1:Column5	0.00	0	0
S2:Column1	-40.43	0	0
S2:Column2	-13.68	0	0
S2:Column3	-58.94	0	0
S2:Column4	-15.74	0	0
S2:Column5	0.00	0	0
S3:Column1	-0.39	0	0
S3:Column2	33.69	0	0
S3:Column3	5.46	0	0

S3:Column4	49.36	0	0
S3:Column5	0.00	0	0
S4:Column1	0.00	0	0
S4:Column2	0.00	0	0
S4:Column3	0.00	0	0
S4:Column4	0.00	0	0
S4:Column5	0.00	0	0
R1:S1	-12.01	0	0
R1:S2	17.28	0	0
R1:S3	18.96	0	0
R1:S4	0.00	0	0
R2:S1	-39.64	0	0
R2:S2	-21.90	0	0
R2:S3	-31.42	0	0
R2:S4	0.00	0	0
R3:S1	-10.98	0	0
R3:S2	-21.39	0	0
R3:S3	14.46	0	0
R3:S4	0.00	0	0
R4:S1	-10.34	0	0
R4:S2	-8.49	0	0
R4:S3	18.78	0	0
R4:S4	0.00	0	0
R5:S1	0.00	0	0
R5:S2	0.00	0	0
R5:S3	0.00	0	0
R5:S4	0.00	0	0
R1:S1:Column1	54.97	0	0
R1:S1:Column2	5.27	0	0
R1:S1:Column3	10.94	0	0
R1:S1:Column4	8.05	0	0
R1:S1:Column5	0.00	0	0
R1:S2:Column1	-24.43	0	0
R1:S2:Column2	-78.73	0	0
R1:S2:Column3	15.88	0	0
R1:S2:Column4	-7.23	0	0
R1:S2:Column5	0.00	0	0
R1:S3:Column1	-11.99	0	0
R1:S3:Column2	-72.89	0	0
R1:S3:Column3	-26.10	0	0
R1:S3:Column4	-40.68	0	0
R1:S3:Column5	0.00	0	0
R1:S4:Column1	0.00	0	0
R1:S4:Column2	0.00	0	0
R1:S4:Column3	0.00	0	0
R1:S4:Column4	0.00	0	0
R1:S4:Column5	0.00	0	0
R2:S1:Column1	86.83	0	0

R2:S1:Column2	87.33	0	0
R2:S1:Column3	76.49	0	0
R2:S1:Column4	7.66	0	0
R2:S1:Column5	0.00	0	0
R2:S2:Column1	67.97	0	0
R2:S2:Column2	0.73	0	0
R2:S2:Column3	71.73	0	0
R2:S2:Column4	20.65	0	0
R2:S2:Column5	0.00	0	0
R2:S3:Column1	46.34	0	0
R2:S3:Column2	13.83	0	0
R2:S3:Column3	66.93	0	0
R2:S3:Column4	-2.28	0	0
R2:S3:Column5	0.00	0	0
R2:S4:Column1	0.00	0	0
R2:S4:Column2	0.00	0	0
R2:S4:Column3	0.00	0	0
R2:S4:Column4	0.00	0	0
R2:S4:Column5	0.00	0	0
R3:S1:Column1	7.17	0	0
R3:S1:Column2	52.01	0	0
R3:S1:Column3	51.42	0	0
R3:S1:Column4	-7.58	0	0
R3:S1:Column5	0.00	0	0
R3:S2:Column1	-5.38	0	0
R3:S2:Column2	12.88	0	0
R3:S2:Column3	83.94	0	0
R3:S2:Column4	26.47	0	0
R3:S2:Column5	0.00	0	0
R3:S3:Column1	-21.65	0	0
R3:S3:Column2	-75.11	0	0
R3:S3:Column3	32.21	0	0
R3:S3:Column4	-48.45	0	0
R3:S3:Column5	0.00	0	0
R3:S4:Column1	0.00	0	0
R3:S4:Column2	0.00	0	0
R3:S4:Column3	0.00	0	0
R3:S4:Column4	0.00	0	0
R3:S4:Column5	0.00	0	0
R4:S1:Column1	14.41	0	0
R4:S1:Column2	35.11	0	0
R4:S1:Column3	54.52	0	0
R4:S1:Column4	-31.57	0	0
R4:S1:Column5	0.00	0	0
R4:S2:Column1	6.58	0	0
R4:S2:Column2	-21.55	0	0
R4:S2:Column3	50.87	0	0
R4:S2:Column4	22.02	0	0

```
R4:S2:Column5     0.00         0             0
R4:S3:Column1    -4.47         0             0
R4:S3:Column2   -52.07         0             0
R4:S3:Column3    -2.11         0             0
R4:S3:Column4   -67.47         0             0
R4:S3:Column5     0.00         0             0
R4:S4:Column1     0.00         0             0
R4:S4:Column2     0.00         0             0
R4:S4:Column3     0.00         0             0
R4:S4:Column4     0.00         0             0
R4:S4:Column5     0.00         0             0
R5:S1:Column1     0.00         0             0
R5:S1:Column2     0.00         0             0
R5:S1:Column3     0.00         0             0
R5:S1:Column4     0.00         0             0
R5:S1:Column5     0.00         0             0
R5:S2:Column1     0.00         0             0
R5:S2:Column2     0.00         0             0
R5:S2:Column3     0.00         0             0
R5:S2:Column4     0.00         0             0
R5:S2:Column5     0.00         0             0
R5:S3:Column1     0.00         0             0
R5:S3:Column2     0.00         0             0
R5:S3:Column3     0.00         0             0
R5:S3:Column4     0.00         0             0
R5:S3:Column5     0.00         0             0
R5:S4:Column1     0.00         0             0
R5:S4:Column2     0.00         0             0
R5:S4:Column3     0.00         0             0
R5:S4:Column4     0.00         0             0
R5:S4:Column5     0.00         0             0
```

(72) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)    1001.61         0             0
Row1             -5.98         0             0
Row2             16.88         0             0
Row3             19.34         0             0
Row4            -24.93         0             0
Row5              0.00         0             0
R1                9.12         0             0
R2              -18.93         0             0
R3               -2.75         0             0
R4                3.02         0             0
R5                0.00         0             0
S1               24.26         0             0
S2               21.85         0             0
S3               -7.81         0             0
S4                0.00         0             0
R1:S1           -12.01         0             0
R1:S2            17.28         0             0
R1:S3            18.96         0             0
R1:S4             0.00         0             0
R2:S1           -39.64         0             0
R2:S2           -21.90         0             0
```

R2:S3	-31.42	0	0
R2:S4	0.00	0	0
R3:S1	-10.98	0	0
R3:S2	-21.39	0	0
R3:S3	14.46	0	0
R3:S4	0.00	0	0
R4:S1	-10.34	0	0
R4:S2	-8.49	0	0
R4:S3	18.78	0	0
R4:S4	0.00	0	0
R5:S1	0.00	0	0
R5:S2	0.00	0	0
R5:S3	0.00	0	0
R5:S4	0.00	0	0
Row1:R1	3.72	0	0
Row1:R2	14.16	0	0
Row1:R3	-24.63	0	0
Row1:R4	3.52	0	0
Row1:R5	0.00	0	0
Row2:R1	-61.81	0	0
Row2:R2	12.43	0	0
Row2:R3	-0.94	0	0
Row2:R4	-20.79	0	0
Row2:R5	0.00	0	0
Row3:R1	-56.60	0	0
Row3:R2	-12.11	0	0
Row3:R3	-30.06	0	0
Row3:R4	-4.44	0	0
Row3:R5	0.00	0	0
Row4:R1	46.95	0	0
Row4:R2	26.04	0	0
Row4:R3	43.63	0	0
Row4:R4	12.51	0	0
Row4:R5	0.00	0	0
Row5:R1	0.00	0	0
Row5:R2	0.00	0	0
Row5:R3	0.00	0	0
Row5:R4	0.00	0	0
Row5:R5	0.00	0	0
S1:Column1	-47.84	0	0
S1:Column2	-58.48	0	0
S1:Column3	-40.38	0	0
S1:Column4	10.08	0	0
S1:Column5	0.00	0	0
S2:Column1	-40.43	0	0
S2:Column2	-13.68	0	0
S2:Column3	-58.94	0	0
S2:Column4	-15.74	0	0

S2:Column5	0.00	0	0
S3:Column1	-0.39	0	0
S3:Column2	33.69	0	0
S3:Column3	5.46	0	0
S3:Column4	49.36	0	0
S3:Column5	0.00	0	0
S4:Column1	0.00	0	0
S4:Column2	0.00	0	0
S4:Column3	0.00	0	0
S4:Column4	0.00	0	0
S4:Column5	0.00	0	0
R1:S1:Column1	54.97	0	0
R1:S1:Column2	5.27	0	0
R1:S1:Column3	10.94	0	0
R1:S1:Column4	8.05	0	0
R1:S1:Column5	0.00	0	0
R1:S2:Column1	-24.43	0	0
R1:S2:Column2	-78.73	0	0
R1:S2:Column3	15.88	0	0
R1:S2:Column4	-7.23	0	0
R1:S2:Column5	0.00	0	0
R1:S3:Column1	-11.99	0	0
R1:S3:Column2	-72.89	0	0
R1:S3:Column3	-26.10	0	0
R1:S3:Column4	-40.68	0	0
R1:S3:Column5	0.00	0	0
R1:S4:Column1	0.00	0	0
R1:S4:Column2	0.00	0	0
R1:S4:Column3	0.00	0	0
R1:S4:Column4	0.00	0	0
R1:S4:Column5	0.00	0	0
R2:S1:Column1	86.83	0	0
R2:S1:Column2	87.33	0	0
R2:S1:Column3	76.49	0	0
R2:S1:Column4	7.66	0	0
R2:S1:Column5	0.00	0	0
R2:S2:Column1	67.97	0	0
R2:S2:Column2	0.73	0	0
R2:S2:Column3	71.73	0	0
R2:S2:Column4	20.65	0	0
R2:S2:Column5	0.00	0	0
R2:S3:Column1	46.34	0	0
R2:S3:Column2	13.83	0	0
R2:S3:Column3	66.93	0	0
R2:S3:Column4	-2.28	0	0
R2:S3:Column5	0.00	0	0
R2:S4:Column1	0.00	0	0
R2:S4:Column2	0.00	0	0

R2:S4:Column3	0.00	0	0
R2:S4:Column4	0.00	0	0
R2:S4:Column5	0.00	0	0
R3:S1:Column1	7.17	0	0
R3:S1:Column2	52.01	0	0
R3:S1:Column3	51.42	0	0
R3:S1:Column4	-7.58	0	0
R3:S1:Column5	0.00	0	0
R3:S2:Column1	-5.38	0	0
R3:S2:Column2	12.88	0	0
R3:S2:Column3	83.94	0	0
R3:S2:Column4	26.47	0	0
R3:S2:Column5	0.00	0	0
R3:S3:Column1	-21.65	0	0
R3:S3:Column2	-75.11	0	0
R3:S3:Column3	32.21	0	0
R3:S3:Column4	-48.45	0	0
R3:S3:Column5	0.00	0	0
R3:S4:Column1	0.00	0	0
R3:S4:Column2	0.00	0	0
R3:S4:Column3	0.00	0	0
R3:S4:Column4	0.00	0	0
R3:S4:Column5	0.00	0	0
R4:S1:Column1	14.41	0	0
R4:S1:Column2	35.11	0	0
R4:S1:Column3	54.52	0	0
R4:S1:Column4	-31.57	0	0
R4:S1:Column5	0.00	0	0
R4:S2:Column1	6.58	0	0
R4:S2:Column2	-21.55	0	0
R4:S2:Column3	50.87	0	0
R4:S2:Column4	22.02	0	0
R4:S2:Column5	0.00	0	0
R4:S3:Column1	-4.47	0	0
R4:S3:Column2	-52.07	0	0
R4:S3:Column3	-2.11	0	0
R4:S3:Column4	-67.47	0	0
R4:S3:Column5	0.00	0	0
R4:S4:Column1	0.00	0	0
R4:S4:Column2	0.00	0	0
R4:S4:Column3	0.00	0	0
R4:S4:Column4	0.00	0	0
R4:S4:Column5	0.00	0	0
R5:S1:Column1	0.00	0	0
R5:S1:Column2	0.00	0	0
R5:S1:Column3	0.00	0	0
R5:S1:Column4	0.00	0	0
R5:S1:Column5	0.00	0	0

```
R5:S2:Column1     0.00         0             0
R5:S2:Column2     0.00         0             0
R5:S2:Column3     0.00         0             0
R5:S2:Column4     0.00         0             0
R5:S2:Column5     0.00         0             0
R5:S3:Column1     0.00         0             0
R5:S3:Column2     0.00         0             0
R5:S3:Column3     0.00         0             0
R5:S3:Column4     0.00         0             0
R5:S3:Column5     0.00         0             0
R5:S4:Column1     0.00         0             0
R5:S4:Column2     0.00         0             0
R5:S4:Column3     0.00         0             0
R5:S4:Column4     0.00         0             0
R5:S4:Column5     0.00         0             0
```

```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

(73) 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 Estimable Std. Error  Df t value  Pr(>|t|)
(Intercept)             6915.2         0     490.58 240 14.0958 < 2.2e-16 ***
Site1                    -54.7         0     693.79 240 -0.0788 0.9372617
Site2                   2003.4         0     693.79 240  2.8877 0.0042356 **
Site3                   2418.5         0     693.79 240  3.4859 0.0005830 ***
Site4                      0.0         0       0.00 240
Site1:BlockR1           4457.0         0     490.58 240  9.0851 < 2.2e-16 ***
Site1:BlockR2           2855.5         0     490.58 240  5.8206 1.868e-08 ***
Site1:BlockR3              0.0         0       0.00 240
Site2:BlockR1           4495.5         0     490.58 240  9.1636 < 2.2e-16 ***
Site2:BlockR2           2894.7         0     490.58 240  5.9006 1.226e-08 ***
Site2:BlockR3              0.0         0       0.00 240
Site3:BlockR1           4527.2         0     490.58 240  9.2283 < 2.2e-16 ***
Site3:BlockR2           2863.7         0     490.58 240  5.8375 1.710e-08 ***
Site3:BlockR3              0.0         0       0.00 240
Site4:BlockR1           4467.3         0     490.58 240  9.1060 < 2.2e-16 ***
Site4:BlockR2           2810.3         0     490.58 240  5.7284 3.022e-08 ***
Site4:BlockR3              0.0         0       0.00 240
AA1                      -91.2         0     693.79 240 -0.1315 0.8954707
AA2                        0.0         0       0.00 240
BB1                     -442.7         0     693.79 240 -0.6380 0.5240537
BB2                     -366.4         0     693.79 240 -0.5281 0.5978905
BB3                     -224.9         0     693.79 240 -0.3242 0.7460791
BB4                     -200.5         0     693.79 240 -0.2890 0.7728360
BB5                        0.0         0       0.00 240
AA1:BB1                   56.4         0     981.16 240  0.0575 0.9541950
AA1:BB2                   76.1         0     981.16 240  0.0775 0.9382554
AA1:BB3                   -3.7         0     981.16 240 -0.0037 0.9970214
AA1:BB4                  141.0         0     981.16 240  0.1437 0.8858525
AA1:BB5                    0.0         0       0.00 240
AA2:BB1                    0.0         0       0.00 240
AA2:BB2                    0.0         0       0.00 240
AA2:BB3                    0.0         0       0.00 240
AA2:BB4                    0.0         0       0.00 240
AA2:BB5                    0.0         0       0.00 240
Site1:AA1                 70.5         0     981.16 240  0.0719 0.9427784
Site1:AA2                  0.0         0       0.00 240
Site2:AA1                  -7.3         0     981.16 240 -0.0074 0.9941105
Site2:AA2                  0.0         0       0.00 240
```

Site3:AA1	64.6	0	981.16	240	0.0658	0.9475734
Site3:AA2	0.0	0	0.00	240		
Site4:AA1	0.0	0	0.00	240		
Site4:AA2	0.0	0	0.00	240		
Site1:BB1	99.7	0	981.16	240	0.1016	0.9191748
Site1:BB2	69.5	0	981.16	240	0.0708	0.9435887
Site1:BB3	127.2	0	981.16	240	0.1297	0.8969180
Site1:BB4	155.4	0	981.16	240	0.1584	0.8742746
Site1:BB5	0.0	0	0.00	240		
Site2:BB1	21.7	0	981.16	240	0.0222	0.9823327
Site2:BB2	4.6	0	981.16	240	0.0047	0.9962767
Site2:BB3	-3.7	0	981.16	240	-0.0037	0.9970214
Site2:BB4	66.5	0	981.16	240	0.0678	0.9460199
Site2:BB5	0.0	0	0.00	240		
Site3:BB1	55.6	0	981.16	240	0.0567	0.9548708
Site3:BB2	74.7	0	981.16	240	0.0762	0.9393354
Site3:BB3	53.5	0	981.16	240	0.0545	0.9565606
Site3:BB4	160.8	0	981.16	240	0.1639	0.8699313
Site3:BB5	0.0	0	0.00	240		
Site4:BB1	0.0	0	0.00	240		
Site4:BB2	0.0	0	0.00	240		
Site4:BB3	0.0	0	0.00	240		
Site4:BB4	0.0	0	0.00	240		
Site4:BB5	0.0	0	0.00	240		
Site1:AA1:BB1	-38.2	0	1387.58	240	-0.0276	0.9780312
Site1:AA1:BB2	-103.7	0	1387.58	240	-0.0747	0.9405072
Site1:AA1:BB3	-46.3	0	1387.58	240	-0.0334	0.9733901
Site1:AA1:BB4	-172.2	0	1387.58	240	-0.1241	0.9013579
Site1:AA1:BB5	0.0	0	0.00	240		
Site1:AA2:BB1	0.0	0	0.00	240		
Site1:AA2:BB2	0.0	0	0.00	240		
Site1:AA2:BB3	0.0	0	0.00	240		
Site1:AA2:BB4	0.0	0	0.00	240		
Site1:AA2:BB5	0.0	0	0.00	240		
Site2:AA1:BB1	-47.2	0	1387.58	240	-0.0340	0.9729117
Site2:AA1:BB2	-26.1	0	1387.58	240	-0.0188	0.9850180
Site2:AA1:BB3	25.0	0	1387.58	240	0.0180	0.9856402
Site2:AA1:BB4	-109.2	0	1387.58	240	-0.0787	0.9373572
Site2:AA1:BB5	0.0	0	0.00	240		
Site2:AA2:BB1	0.0	0	0.00	240		
Site2:AA2:BB2	0.0	0	0.00	240		
Site2:AA2:BB3	0.0	0	0.00	240		
Site2:AA2:BB4	0.0	0	0.00	240		
Site2:AA2:BB5	0.0	0	0.00	240		
Site3:AA1:BB1	-48.0	0	1387.58	240	-0.0346	0.9724333
Site3:AA1:BB2	-87.7	0	1387.58	240	-0.0632	0.9496282
Site3:AA1:BB3	1.3	0	1387.58	240	0.0010	0.9992341
Site3:AA1:BB4	-86.4	0	1387.58	240	-0.0623	0.9503926

Site3:AA1:BB5	0.0	0	0.00	240		
Site3:AA2:BB1	0.0	0	0.00	240		
Site3:AA2:BB2	0.0	0	0.00	240		
Site3:AA2:BB3	0.0	0	0.00	240		
Site3:AA2:BB4	0.0	0	0.00	240		
Site3:AA2:BB5	0.0	0	0.00	240		
Site4:AA1:BB1	0.0	0	0.00	240		
Site4:AA1:BB2	0.0	0	0.00	240		
Site4:AA1:BB3	0.0	0	0.00	240		
Site4:AA1:BB4	0.0	0	0.00	240		
Site4:AA1:BB5	0.0	0	0.00	240		
Site4:AA2:BB1	0.0	0	0.00	240		
Site4:AA2:BB2	0.0	0	0.00	240		
Site4:AA2:BB3	0.0	0	0.00	240		
Site4:AA2:BB4	0.0	0	0.00	240		
Site4:AA2:BB5	0.0	0	0.00	240		
Site1:BlockR1:AA1:BB1	-928.2	0	693.79	240	-1.3379	0.1821806
Site1:BlockR1:AA1:BB2	-733.2	0	693.79	240	-1.0569	0.2916292
Site1:BlockR1:AA1:BB3	-514.0	0	693.79	240	-0.7409	0.4595022
Site1:BlockR1:AA1:BB4	-350.2	0	693.79	240	-0.5048	0.6141363
Site1:BlockR1:AA1:BB5	-106.7	0	693.79	240	-0.1539	0.8778451
Site1:BlockR1:AA2:BB1	-900.7	0	693.79	240	-1.2983	0.1954278
Site1:BlockR1:AA2:BB2	-683.7	0	693.79	240	-0.9855	0.3253553
Site1:BlockR1:AA2:BB3	-415.7	0	693.79	240	-0.5992	0.5495736
Site1:BlockR1:AA2:BB4	-216.5	0	693.79	240	-0.3121	0.7552696
Site1:BlockR1:AA2:BB5	0.0	0	0.00	240		
Site1:BlockR2:AA1:BB1	-744.0	0	693.79	240	-1.0724	0.2846291
Site1:BlockR2:AA1:BB2	-533.0	0	693.79	240	-0.7682	0.4430960
Site1:BlockR2:AA1:BB3	-417.7	0	693.79	240	-0.6021	0.5476564
Site1:BlockR2:AA1:BB4	-277.7	0	693.79	240	-0.4003	0.6892633
Site1:BlockR2:AA1:BB5	-80.0	0	693.79	240	-0.1153	0.9082966
Site1:BlockR2:AA2:BB1	-713.2	0	693.79	240	-1.0281	0.3049602
Site1:BlockR2:AA2:BB2	-488.5	0	693.79	240	-0.7041	0.4820495
Site1:BlockR2:AA2:BB3	-373.2	0	693.79	240	-0.5380	0.5910833
Site1:BlockR2:AA2:BB4	-231.2	0	693.79	240	-0.3333	0.7391874
Site1:BlockR2:AA2:BB5	0.0	0	0.00	240		
Site1:BlockR3:AA1:BB1	0.0	0	0.00	240		
Site1:BlockR3:AA1:BB2	0.0	0	0.00	240		
Site1:BlockR3:AA1:BB3	0.0	0	0.00	240		
Site1:BlockR3:AA1:BB4	0.0	0	0.00	240		
Site1:BlockR3:AA1:BB5	0.0	0	0.00	240		
Site1:BlockR3:AA2:BB1	0.0	0	0.00	240		
Site1:BlockR3:AA2:BB2	0.0	0	0.00	240		
Site1:BlockR3:AA2:BB3	0.0	0	0.00	240		
Site1:BlockR3:AA2:BB4	0.0	0	0.00	240		
Site1:BlockR3:AA2:BB5	0.0	0	0.00	240		
Site2:BlockR1:AA1:BB1	-974.5	0	693.79	240	-1.4046	0.1614307
Site2:BlockR1:AA1:BB2	-779.5	0	693.79	240	-1.1235	0.2623297

Site2:BlockR1:AA1:BB3	-559.5	0	693.79	240	-0.8064	0.4207860
Site2:BlockR1:AA1:BB4	-301.0	0	693.79	240	-0.4339	0.6647869
Site2:BlockR1:AA1:BB5	-172.0	0	693.79	240	-0.2479	0.8044126
Site2:BlockR1:AA2:BB1	-878.8	0	693.79	240	-1.2666	0.2065270
Site2:BlockR1:AA2:BB2	-603.5	0	693.79	240	-0.8699	0.3852446
Site2:BlockR1:AA2:BB3	-392.3	0	693.79	240	-0.5654	0.5723471
Site2:BlockR1:AA2:BB4	-212.5	0	693.79	240	-0.3063	0.7596497
Site2:BlockR1:AA2:BB5	0.0	0	0.00	240		
Site2:BlockR2:AA1:BB1	-725.0	0	693.79	240	-1.0450	0.2970798
Site2:BlockR2:AA1:BB2	-572.5	0	693.79	240	-0.8252	0.4100886
Site2:BlockR2:AA1:BB3	-427.2	0	693.79	240	-0.6158	0.5385953
Site2:BlockR2:AA1:BB4	-278.0	0	693.79	240	-0.4007	0.6889983
Site2:BlockR2:AA1:BB5	-144.5	0	693.79	240	-0.2083	0.8351894
Site2:BlockR2:AA2:BB1	-629.5	0	693.79	240	-0.9073	0.3651382
Site2:BlockR2:AA2:BB2	-530.0	0	693.79	240	-0.7639	0.4456638
Site2:BlockR2:AA2:BB3	-304.0	0	693.79	240	-0.4382	0.6616540
Site2:BlockR2:AA2:BB4	-204.5	0	693.79	240	-0.2948	0.7684330
Site2:BlockR2:AA2:BB5	0.0	0	0.00	240		
Site2:BlockR3:AA1:BB1	0.0	0	0.00	240		
Site2:BlockR3:AA1:BB2	0.0	0	0.00	240		
Site2:BlockR3:AA1:BB3	0.0	0	0.00	240		
Site2:BlockR3:AA1:BB4	0.0	0	0.00	240		
Site2:BlockR3:AA1:BB5	0.0	0	0.00	240		
Site2:BlockR3:AA2:BB1	0.0	0	0.00	240		
Site2:BlockR3:AA2:BB2	0.0	0	0.00	240		
Site2:BlockR3:AA2:BB3	0.0	0	0.00	240		
Site2:BlockR3:AA2:BB4	0.0	0	0.00	240		
Site2:BlockR3:AA2:BB5	0.0	0	0.00	240		
Site3:BlockR1:AA1:BB1	-1029.0	0	693.79	240	-1.4832	0.1393432
Site3:BlockR1:AA1:BB2	-781.0	0	693.79	240	-1.1257	0.2614150
Site3:BlockR1:AA1:BB3	-555.2	0	693.79	240	-0.8003	0.4243187
Site3:BlockR1:AA1:BB4	-442.5	0	693.79	240	-0.6378	0.5242099
Site3:BlockR1:AA1:BB5	-152.7	0	693.79	240	-0.2202	0.8259273
Site3:BlockR1:AA2:BB1	-858.5	0	693.79	240	-1.2374	0.2171441
Site3:BlockR1:AA2:BB2	-683.7	0	693.79	240	-0.9855	0.3253553
Site3:BlockR1:AA2:BB3	-453.7	0	693.79	240	-0.6540	0.5137261
Site3:BlockR1:AA2:BB4	-213.2	0	693.79	240	-0.3074	0.7588278
Site3:BlockR1:AA2:BB5	0.0	0	0.00	240		
Site3:BlockR2:AA1:BB1	-756.0	0	693.79	240	-1.0897	0.2769512
Site3:BlockR2:AA1:BB2	-566.0	0	693.79	240	-0.8158	0.4154169
Site3:BlockR2:AA1:BB3	-354.5	0	693.79	240	-0.5110	0.6098465
Site3:BlockR2:AA1:BB4	-266.2	0	693.79	240	-0.3838	0.7014939
Site3:BlockR2:AA1:BB5	-87.2	0	693.79	240	-0.1258	0.9000280
Site3:BlockR2:AA2:BB1	-619.2	0	693.79	240	-0.8926	0.3729847
Site3:BlockR2:AA2:BB2	-448.2	0	693.79	240	-0.6461	0.5188377
Site3:BlockR2:AA2:BB3	-261.0	0	693.79	240	-0.3762	0.7071037
Site3:BlockR2:AA2:BB4	-175.7	0	693.79	240	-0.2533	0.8002381
Site3:BlockR2:AA2:BB5	0.0	0	0.00	240		

Site3:BlockR3:AA1:BB1	0.0	0	0.00	240			
Site3:BlockR3:AA1:BB2	0.0	0	0.00	240			
Site3:BlockR3:AA1:BB3	0.0	0	0.00	240			
Site3:BlockR3:AA1:BB4	0.0	0	0.00	240			
Site3:BlockR3:AA1:BB5	0.0	0	0.00	240			
Site3:BlockR3:AA2:BB1	0.0	0	0.00	240			
Site3:BlockR3:AA2:BB2	0.0	0	0.00	240			
Site3:BlockR3:AA2:BB3	0.0	0	0.00	240			
Site3:BlockR3:AA2:BB4	0.0	0	0.00	240			
Site3:BlockR3:AA2:BB5	0.0	0	0.00	240			
Site4:BlockR1:AA1:BB1	-920.0	0	693.79	240	-1.3261	0.1860824	
Site4:BlockR1:AA1:BB2	-756.0	0	693.79	240	-1.0897	0.2769512	
Site4:BlockR1:AA1:BB3	-550.5	0	693.79	240	-0.7935	0.4282876	
Site4:BlockR1:AA1:BB4	-312.5	0	693.79	240	-0.4504	0.6528099	
Site4:BlockR1:AA1:BB5	-94.0	0	693.79	240	-0.1355	0.8923395	
Site4:BlockR1:AA2:BB1	-825.8	0	693.79	240	-1.1902	0.2351416	
Site4:BlockR1:AA2:BB2	-603.3	0	693.79	240	-0.8695	0.3854412	
Site4:BlockR1:AA2:BB3	-425.0	0	693.79	240	-0.6126	0.5407345	
Site4:BlockR1:AA2:BB4	-154.8	0	693.79	240	-0.2231	0.8236856	
Site4:BlockR1:AA2:BB5	0.0	0	0.00	240			
Site4:BlockR2:AA1:BB1	-664.5	0	693.79	240	-0.9578	0.3391346	
Site4:BlockR2:AA1:BB2	-552.3	0	693.79	240	-0.7960	0.4268228	
Site4:BlockR2:AA1:BB3	-366.0	0	693.79	240	-0.5275	0.5983068	
Site4:BlockR2:AA1:BB4	-213.3	0	693.79	240	-0.3074	0.7588278	
Site4:BlockR2:AA1:BB5	-1.3	0	693.79	240	-0.0018	0.9985639	
Site4:BlockR2:AA2:BB1	-547.3	0	693.79	240	-0.7888	0.4310156	
Site4:BlockR2:AA2:BB2	-434.5	0	693.79	240	-0.6263	0.5317316	
Site4:BlockR2:AA2:BB3	-320.3	0	693.79	240	-0.4616	0.6447888	
Site4:BlockR2:AA2:BB4	-79.8	0	693.79	240	-0.1149	0.9085819	
Site4:BlockR2:AA2:BB5	0.0	0	0.00	240			
Site4:BlockR3:AA1:BB1	0.0	0	0.00	240			
Site4:BlockR3:AA1:BB2	0.0	0	0.00	240			
Site4:BlockR3:AA1:BB3	0.0	0	0.00	240			
Site4:BlockR3:AA1:BB4	0.0	0	0.00	240			
Site4:BlockR3:AA1:BB5	0.0	0	0.00	240			
Site4:BlockR3:AA2:BB1	0.0	0	0.00	240			
Site4:BlockR3:AA2:BB2	0.0	0	0.00	240			
Site4:BlockR3:AA2:BB3	0.0	0	0.00	240			
Site4:BlockR3:AA2:BB4	0.0	0	0.00	240			
Site4:BlockR3:AA2:BB5	0.0	0	0.00	240			
CC1	-3320.7	0	566.48	240	-5.8620	1.503e-08	***
CC2	-2205.0	0	566.48	240	-3.8925	0.0001286	***
CC3	-1108.0	0	566.48	240	-1.9560	0.0516306	.
CC4	0.0	0	0.00	240			
AA1:CC1	-1.7	0	801.12	240	-0.0021	0.9983418	
AA1:CC2	-17.0	0	801.12	240	-0.0212	0.9830875	
AA1:CC3	21.7	0	801.12	240	0.0270	0.9784459	
AA1:CC4	0.0	0	0.00	240			

AA2:CC1	0.0	0	0.00	240		
AA2:CC2	0.0	0	0.00	240		
AA2:CC3	0.0	0	0.00	240		
AA2:CC4	0.0	0	0.00	240		
BB1:CC1	-36.7	0	801.12	240	-0.0458	0.9635321
BB1:CC2	-13.0	0	801.12	240	-0.0162	0.9870665
BB1:CC3	13.3	0	801.12	240	0.0166	0.9867349
BB1:CC4	0.0	0	0.00	240		
BB2:CC1	-28.0	0	801.12	240	-0.0350	0.9721477
BB2:CC2	27.7	0	801.12	240	0.0345	0.9724791
BB2:CC3	62.0	0	801.12	240	0.0774	0.9383762
BB2:CC4	0.0	0	0.00	240		
BB3:CC1	-21.0	0	801.12	240	-0.0262	0.9791089
BB3:CC2	20.3	0	801.12	240	0.0254	0.9797720
BB3:CC3	36.3	0	801.12	240	0.0454	0.9638634
BB3:CC4	0.0	0	0.00	240		
BB4:CC1	18.7	0	801.12	240	0.0233	0.9814297
BB4:CC2	28.0	0	801.12	240	0.0350	0.9721477
BB4:CC3	84.3	0	801.12	240	0.1053	0.9162497
BB4:CC4	0.0	0	0.00	240		
BB5:CC1	0.0	0	0.00	240		
BB5:CC2	0.0	0	0.00	240		
BB5:CC3	0.0	0	0.00	240		
BB5:CC4	0.0	0	0.00	240		
AA1:BB1:CC1	51.7	0	1132.95	240	0.0456	0.9636641
AA1:BB1:CC2	7.7	0	1132.95	240	0.0068	0.9946064
AA1:BB1:CC3	-16.0	0	1132.95	240	-0.0141	0.9887440
AA1:BB1:CC4	0.0	0	0.00	240		
AA1:BB2:CC1	51.3	0	1132.95	240	0.0453	0.9638984
AA1:BB2:CC2	-52.3	0	1132.95	240	-0.0462	0.9631956
AA1:BB2:CC3	-88.3	0	1132.95	240	-0.0780	0.9379189
AA1:BB2:CC4	0.0	0	0.00	240		
AA1:BB3:CC1	97.3	0	1132.95	240	0.0859	0.9316085
AA1:BB3:CC2	74.0	0	1132.95	240	0.0653	0.9479766
AA1:BB3:CC3	-26.7	0	1132.95	240	-0.0235	0.9812412
AA1:BB3:CC4	0.0	0	0.00	240		
AA1:BB4:CC1	-78.0	0	1132.95	240	-0.0688	0.9451689
AA1:BB4:CC2	-27.7	0	1132.95	240	-0.0244	0.9805379
AA1:BB4:CC3	-67.3	0	1132.95	240	-0.0594	0.9526576
AA1:BB4:CC4	0.0	0	0.00	240		
AA1:BB5:CC1	0.0	0	0.00	240		
AA1:BB5:CC2	0.0	0	0.00	240		
AA1:BB5:CC3	0.0	0	0.00	240		
AA1:BB5:CC4	0.0	0	0.00	240		
AA2:BB1:CC1	0.0	0	0.00	240		
AA2:BB1:CC2	0.0	0	0.00	240		
AA2:BB1:CC3	0.0	0	0.00	240		
AA2:BB1:CC4	0.0	0	0.00	240		

AA2:BB2:CC1	0.0	0	0.00	240		
AA2:BB2:CC2	0.0	0	0.00	240		
AA2:BB2:CC3	0.0	0	0.00	240		
AA2:BB2:CC4	0.0	0	0.00	240		
AA2:BB3:CC1	0.0	0	0.00	240		
AA2:BB3:CC2	0.0	0	0.00	240		
AA2:BB3:CC3	0.0	0	0.00	240		
AA2:BB3:CC4	0.0	0	0.00	240		
AA2:BB4:CC1	0.0	0	0.00	240		
AA2:BB4:CC2	0.0	0	0.00	240		
AA2:BB4:CC3	0.0	0	0.00	240		
AA2:BB4:CC4	0.0	0	0.00	240		
AA2:BB5:CC1	0.0	0	0.00	240		
AA2:BB5:CC2	0.0	0	0.00	240		
AA2:BB5:CC3	0.0	0	0.00	240		
AA2:BB5:CC4	0.0	0	0.00	240		
Site1:CC1	31.3	0	801.12	240	0.0391	0.9688336
Site1:CC2	26.7	0	801.12	240	0.0333	0.9734735
Site1:CC3	26.7	0	801.12	240	0.0333	0.9734735
Site1:CC4	0.0	0	0.00	240		
Site2:CC1	-29.0	0	801.12	240	-0.0362	0.9711534
Site2:CC2	-72.3	0	801.12	240	-0.0903	0.9281316
Site2:CC3	-10.3	0	801.12	240	-0.0129	0.9897194
Site2:CC4	0.0	0	0.00	240		
Site3:CC1	1.7	0	801.12	240	0.0021	0.9983418
Site3:CC2	-7.0	0	801.12	240	-0.0087	0.9930356
Site3:CC3	-15.7	0	801.12	240	-0.0196	0.9844138
Site3:CC4	0.0	0	0.00	240		
Site4:CC1	0.0	0	0.00	240		
Site4:CC2	0.0	0	0.00	240		
Site4:CC3	0.0	0	0.00	240		
Site4:CC4	0.0	0	0.00	240		
Site1:AA1:CC1	-10.0	0	1132.95	240	-0.0088	0.9929649
Site1:AA1:CC2	-15.0	0	1132.95	240	-0.0132	0.9894475
Site1:AA1:CC3	-29.0	0	1132.95	240	-0.0256	0.9796001
Site1:AA1:CC4	0.0	0	0.00	240		
Site1:AA2:CC1	0.0	0	0.00	240		
Site1:AA2:CC2	0.0	0	0.00	240		
Site1:AA2:CC3	0.0	0	0.00	240		
Site1:AA2:CC4	0.0	0	0.00	240		
Site2:AA1:CC1	62.0	0	1132.95	240	0.0547	0.9564036
Site2:AA1:CC2	156.7	0	1132.95	240	0.1383	0.8901335
Site2:AA1:CC3	-20.7	0	1132.95	240	-0.0182	0.9854614
Site2:AA1:CC4	0.0	0	0.00	240		
Site2:AA2:CC1	0.0	0	0.00	240		
Site2:AA2:CC2	0.0	0	0.00	240		
Site2:AA2:CC3	0.0	0	0.00	240		
Site2:AA2:CC4	0.0	0	0.00	240		

Site3:AA1:CC1	-48.0	0	1132.95	240	-0.0424	0.9662412
Site3:AA1:CC2	9.0	0	1132.95	240	0.0079	0.9936684
Site3:AA1:CC3	48.7	0	1132.95	240	0.0430	0.9657726
Site3:AA1:CC4	0.0	0	0.00	240		
Site3:AA2:CC1	0.0	0	0.00	240		
Site3:AA2:CC2	0.0	0	0.00	240		
Site3:AA2:CC3	0.0	0	0.00	240		
Site3:AA2:CC4	0.0	0	0.00	240		
Site4:AA1:CC1	0.0	0	0.00	240		
Site4:AA1:CC2	0.0	0	0.00	240		
Site4:AA1:CC3	0.0	0	0.00	240		
Site4:AA1:CC4	0.0	0	0.00	240		
Site4:AA2:CC1	0.0	0	0.00	240		
Site4:AA2:CC2	0.0	0	0.00	240		
Site4:AA2:CC3	0.0	0	0.00	240		
Site4:AA2:CC4	0.0	0	0.00	240		
Site1:BB1:CC1	-6.0	0	1132.95	240	-0.0053	0.9957789
Site1:BB1:CC2	-62.0	0	1132.95	240	-0.0547	0.9564036
Site1:BB1:CC3	6.3	0	1132.95	240	0.0056	0.9955444
Site1:BB1:CC4	0.0	0	0.00	240		
Site1:BB2:CC1	61.0	0	1132.95	240	0.0538	0.9571061
Site1:BB2:CC2	-57.0	0	1132.95	240	-0.0503	0.9599163
Site1:BB2:CC3	-38.0	0	1132.95	240	-0.0335	0.9732713
Site1:BB2:CC4	0.0	0	0.00	240		
Site1:BB3:CC1	-85.7	0	1132.95	240	-0.0756	0.9397894
Site1:BB3:CC2	-116.0	0	1132.95	240	-0.1024	0.9185346
Site1:BB3:CC3	-108.3	0	1132.95	240	-0.0956	0.9239018
Site1:BB3:CC4	0.0	0	0.00	240		
Site1:BB4:CC1	-74.7	0	1132.95	240	-0.0659	0.9475086
Site1:BB4:CC2	-36.7	0	1132.95	240	-0.0324	0.9742088
Site1:BB4:CC3	-138.3	0	1132.95	240	-0.1221	0.9029220
Site1:BB4:CC4	0.0	0	0.00	240		
Site1:BB5:CC1	0.0	0	0.00	240		
Site1:BB5:CC2	0.0	0	0.00	240		
Site1:BB5:CC3	0.0	0	0.00	240		
Site1:BB5:CC4	0.0	0	0.00	240		
Site2:BB1:CC1	59.3	0	1132.95	240	0.0524	0.9582769
Site2:BB1:CC2	43.0	0	1132.95	240	0.0380	0.9697559
Site2:BB1:CC3	18.7	0	1132.95	240	0.0165	0.9868682
Site2:BB1:CC4	0.0	0	0.00	240		
Site2:BB2:CC1	54.3	0	1132.95	240	0.0480	0.9617901
Site2:BB2:CC2	95.3	0	1132.95	240	0.0841	0.9330104
Site2:BB2:CC3	-54.0	0	1132.95	240	-0.0477	0.9620243
Site2:BB2:CC4	0.0	0	0.00	240		
Site2:BB3:CC1	-55.3	0	1132.95	240	-0.0488	0.9610874
Site2:BB3:CC2	81.3	0	1132.95	240	0.0718	0.9428297
Site2:BB3:CC3	-2.3	0	1132.95	240	-0.0021	0.9983585
Site2:BB3:CC4	0.0	0	0.00	240		

Site2:BB4:CC1	-32.0	0	1132.95	240	-0.0282	0.9774904
Site2:BB4:CC2	13.0	0	1132.95	240	0.0115	0.9908544
Site2:BB4:CC3	-63.0	0	1132.95	240	-0.0556	0.9557011
Site2:BB4:CC4	0.0	0	0.00	240		
Site2:BB5:CC1	0.0	0	0.00	240		
Site2:BB5:CC2	0.0	0	0.00	240		
Site2:BB5:CC3	0.0	0	0.00	240		
Site2:BB5:CC4	0.0	0	0.00	240		
Site3:BB1:CC1	39.3	0	1132.95	240	0.0347	0.9723338
Site3:BB1:CC2	19.0	0	1132.95	240	0.0168	0.9866337
Site3:BB1:CC3	19.3	0	1132.95	240	0.0171	0.9863993
Site3:BB1:CC4	0.0	0	0.00	240		
Site3:BB2:CC1	73.3	0	1132.95	240	0.0647	0.9484447
Site3:BB2:CC2	-66.0	0	1132.95	240	-0.0583	0.9535940
Site3:BB2:CC3	-28.3	0	1132.95	240	-0.0250	0.9800690
Site3:BB2:CC4	0.0	0	0.00	240		
Site3:BB3:CC1	1.3	0	1132.95	240	0.0012	0.9990620
Site3:BB3:CC2	-49.0	0	1132.95	240	-0.0432	0.9655383
Site3:BB3:CC3	26.7	0	1132.95	240	0.0235	0.9812412
Site3:BB3:CC4	0.0	0	0.00	240		
Site3:BB4:CC1	-61.0	0	1132.95	240	-0.0538	0.9571061
Site3:BB4:CC2	-65.7	0	1132.95	240	-0.0580	0.9538281
Site3:BB4:CC3	-103.7	0	1132.95	240	-0.0915	0.9271704
Site3:BB4:CC4	0.0	0	0.00	240		
Site3:BB5:CC1	0.0	0	0.00	240		
Site3:BB5:CC2	0.0	0	0.00	240		
Site3:BB5:CC3	0.0	0	0.00	240		
Site3:BB5:CC4	0.0	0	0.00	240		
Site4:BB1:CC1	0.0	0	0.00	240		
Site4:BB1:CC2	0.0	0	0.00	240		
Site4:BB1:CC3	0.0	0	0.00	240		
Site4:BB1:CC4	0.0	0	0.00	240		
Site4:BB2:CC1	0.0	0	0.00	240		
Site4:BB2:CC2	0.0	0	0.00	240		
Site4:BB2:CC3	0.0	0	0.00	240		
Site4:BB2:CC4	0.0	0	0.00	240		
Site4:BB3:CC1	0.0	0	0.00	240		
Site4:BB3:CC2	0.0	0	0.00	240		
Site4:BB3:CC3	0.0	0	0.00	240		
Site4:BB3:CC4	0.0	0	0.00	240		
Site4:BB4:CC1	0.0	0	0.00	240		
Site4:BB4:CC2	0.0	0	0.00	240		
Site4:BB4:CC3	0.0	0	0.00	240		
Site4:BB4:CC4	0.0	0	0.00	240		
Site4:BB5:CC1	0.0	0	0.00	240		
Site4:BB5:CC2	0.0	0	0.00	240		
Site4:BB5:CC3	0.0	0	0.00	240		
Site4:BB5:CC4	0.0	0	0.00	240		

Site1:AA1:BB1:CC1	-66.7	0	1602.23	240	-0.0416	0.9668453
Site1:AA1:BB1:CC2	-16.3	0	1602.23	240	-0.0102	0.9918749
Site1:AA1:BB1:CC3	-86.0	0	1602.23	240	-0.0537	0.9572387
Site1:AA1:BB1:CC4	0.0	0	0.00	240		
Site1:AA1:BB2:CC1	-31.0	0	1602.23	240	-0.0193	0.9845796
Site1:AA1:BB2:CC2	81.3	0	1602.23	240	0.0508	0.9595570
Site1:AA1:BB2:CC3	58.3	0	1602.23	240	0.0364	0.9709877
Site1:AA1:BB2:CC4	0.0	0	0.00	240		
Site1:AA1:BB3:CC1	-103.3	0	1602.23	240	-0.0645	0.9486311
Site1:AA1:BB3:CC2	-3.7	0	1602.23	240	-0.0023	0.9981760
Site1:AA1:BB3:CC3	45.3	0	1602.23	240	0.0283	0.9774513
Site1:AA1:BB3:CC4	0.0	0	0.00	240		
Site1:AA1:BB4:CC1	137.3	0	1602.23	240	0.0857	0.9317655
Site1:AA1:BB4:CC2	69.3	0	1602.23	240	0.0433	0.9655200
Site1:AA1:BB4:CC3	137.0	0	1602.23	240	0.0855	0.9319307
Site1:AA1:BB4:CC4	0.0	0	0.00	240		
Site1:AA1:BB5:CC1	0.0	0	0.00	240		
Site1:AA1:BB5:CC2	0.0	0	0.00	240		
Site1:AA1:BB5:CC3	0.0	0	0.00	240		
Site1:AA1:BB5:CC4	0.0	0	0.00	240		
Site1:AA2:BB1:CC1	0.0	0	0.00	240		
Site1:AA2:BB1:CC2	0.0	0	0.00	240		
Site1:AA2:BB1:CC3	0.0	0	0.00	240		
Site1:AA2:BB1:CC4	0.0	0	0.00	240		
Site1:AA2:BB2:CC1	0.0	0	0.00	240		
Site1:AA2:BB2:CC2	0.0	0	0.00	240		
Site1:AA2:BB2:CC3	0.0	0	0.00	240		
Site1:AA2:BB2:CC4	0.0	0	0.00	240		
Site1:AA2:BB3:CC1	0.0	0	0.00	240		
Site1:AA2:BB3:CC2	0.0	0	0.00	240		
Site1:AA2:BB3:CC3	0.0	0	0.00	240		
Site1:AA2:BB3:CC4	0.0	0	0.00	240		
Site1:AA2:BB4:CC1	0.0	0	0.00	240		
Site1:AA2:BB4:CC2	0.0	0	0.00	240		
Site1:AA2:BB4:CC3	0.0	0	0.00	240		
Site1:AA2:BB4:CC4	0.0	0	0.00	240		
Site1:AA2:BB5:CC1	0.0	0	0.00	240		
Site1:AA2:BB5:CC2	0.0	0	0.00	240		
Site1:AA2:BB5:CC3	0.0	0	0.00	240		
Site1:AA2:BB5:CC4	0.0	0	0.00	240		
Site2:AA1:BB1:CC1	-130.0	0	1602.23	240	-0.0811	0.9354009
Site2:AA1:BB1:CC2	-79.0	0	1602.23	240	-0.0493	0.9607163
Site2:AA1:BB1:CC3	17.7	0	1602.23	240	0.0110	0.9912116
Site2:AA1:BB1:CC4	0.0	0	0.00	240		
Site2:AA1:BB2:CC1	-128.0	0	1602.23	240	-0.0799	0.9363925
Site2:AA1:BB2:CC2	-92.0	0	1602.23	240	-0.0574	0.9542585
Site2:AA1:BB2:CC3	160.3	0	1602.23	240	0.1001	0.9203734
Site2:AA1:BB2:CC4	0.0	0	0.00	240		

Site2:AA1:BB3:CC1	-49.0	0	1602.23	240	-0.0306	0.9756281
Site2:AA1:BB3:CC2	-220.3	0	1602.23	240	-0.1375	0.8907380
Site2:AA1:BB3:CC3	51.3	0	1602.23	240	0.0320	0.9744679
Site2:AA1:BB3:CC4	0.0	0	0.00	240		
Site2:AA1:BB4:CC1	60.7	0	1602.23	240	0.0379	0.9698278
Site2:AA1:BB4:CC2	-81.7	0	1602.23	240	-0.0510	0.9593914
Site2:AA1:BB4:CC3	37.7	0	1602.23	240	0.0235	0.9812639
Site2:AA1:BB4:CC4	0.0	0	0.00	240		
Site2:AA1:BB5:CC1	0.0	0	0.00	240		
Site2:AA1:BB5:CC2	0.0	0	0.00	240		
Site2:AA1:BB5:CC3	0.0	0	0.00	240		
Site2:AA1:BB5:CC4	0.0	0	0.00	240		
Site2:AA2:BB1:CC1	0.0	0	0.00	240		
Site2:AA2:BB1:CC2	0.0	0	0.00	240		
Site2:AA2:BB1:CC3	0.0	0	0.00	240		
Site2:AA2:BB1:CC4	0.0	0	0.00	240		
Site2:AA2:BB2:CC1	0.0	0	0.00	240		
Site2:AA2:BB2:CC2	0.0	0	0.00	240		
Site2:AA2:BB2:CC3	0.0	0	0.00	240		
Site2:AA2:BB2:CC4	0.0	0	0.00	240		
Site2:AA2:BB3:CC1	0.0	0	0.00	240		
Site2:AA2:BB3:CC2	0.0	0	0.00	240		
Site2:AA2:BB3:CC3	0.0	0	0.00	240		
Site2:AA2:BB3:CC4	0.0	0	0.00	240		
Site2:AA2:BB4:CC1	0.0	0	0.00	240		
Site2:AA2:BB4:CC2	0.0	0	0.00	240		
Site2:AA2:BB4:CC3	0.0	0	0.00	240		
Site2:AA2:BB4:CC4	0.0	0	0.00	240		
Site2:AA2:BB5:CC1	0.0	0	0.00	240		
Site2:AA2:BB5:CC2	0.0	0	0.00	240		
Site2:AA2:BB5:CC3	0.0	0	0.00	240		
Site2:AA2:BB5:CC4	0.0	0	0.00	240		
Site3:AA1:BB1:CC1	60.7	0	1602.23	240	0.0379	0.9698278
Site3:AA1:BB1:CC2	-3.3	0	1602.23	240	-0.0021	0.9983418
Site3:AA1:BB1:CC3	-8.3	0	1602.23	240	-0.0052	0.9958545
Site3:AA1:BB1:CC4	0.0	0	0.00	240		
Site3:AA1:BB2:CC1	-47.3	0	1602.23	240	-0.0295	0.9764568
Site3:AA1:BB2:CC2	138.0	0	1602.23	240	0.0861	0.9314351
Site3:AA1:BB2:CC3	44.3	0	1602.23	240	0.0277	0.9779486
Site3:AA1:BB2:CC4	0.0	0	0.00	240		
Site3:AA1:BB3:CC1	-51.7	0	1602.23	240	-0.0322	0.9743022
Site3:AA1:BB3:CC2	-49.0	0	1602.23	240	-0.0306	0.9756281
Site3:AA1:BB3:CC3	-70.7	0	1602.23	240	-0.0441	0.9648573
Site3:AA1:BB3:CC4	0.0	0	0.00	240		
Site3:AA1:BB4:CC1	114.0	0	1602.23	240	0.0712	0.9433371
Site3:AA1:BB4:CC2	45.0	0	1602.23	240	0.0281	0.9776171
Site3:AA1:BB4:CC3	19.7	0	1602.23	240	0.0123	0.9902168
Site3:AA1:BB4:CC4	0.0	0	0.00	240		

Site3:AA1:BB5:CC1	0.0	0	0.00	240
Site3:AA1:BB5:CC2	0.0	0	0.00	240
Site3:AA1:BB5:CC3	0.0	0	0.00	240
Site3:AA1:BB5:CC4	0.0	0	0.00	240
Site3:AA2:BB1:CC1	0.0	0	0.00	240
Site3:AA2:BB1:CC2	0.0	0	0.00	240
Site3:AA2:BB1:CC3	0.0	0	0.00	240
Site3:AA2:BB1:CC4	0.0	0	0.00	240
Site3:AA2:BB2:CC1	0.0	0	0.00	240
Site3:AA2:BB2:CC2	0.0	0	0.00	240
Site3:AA2:BB2:CC3	0.0	0	0.00	240
Site3:AA2:BB2:CC4	0.0	0	0.00	240
Site3:AA2:BB3:CC1	0.0	0	0.00	240
Site3:AA2:BB3:CC2	0.0	0	0.00	240
Site3:AA2:BB3:CC3	0.0	0	0.00	240
Site3:AA2:BB3:CC4	0.0	0	0.00	240
Site3:AA2:BB4:CC1	0.0	0	0.00	240
Site3:AA2:BB4:CC2	0.0	0	0.00	240
Site3:AA2:BB4:CC3	0.0	0	0.00	240
Site3:AA2:BB4:CC4	0.0	0	0.00	240
Site3:AA2:BB5:CC1	0.0	0	0.00	240
Site3:AA2:BB5:CC2	0.0	0	0.00	240
Site3:AA2:BB5:CC3	0.0	0	0.00	240
Site3:AA2:BB5:CC4	0.0	0	0.00	240
Site4:AA1:BB1:CC1	0.0	0	0.00	240
Site4:AA1:BB1:CC2	0.0	0	0.00	240
Site4:AA1:BB1:CC3	0.0	0	0.00	240
Site4:AA1:BB1:CC4	0.0	0	0.00	240
Site4:AA1:BB2:CC1	0.0	0	0.00	240
Site4:AA1:BB2:CC2	0.0	0	0.00	240
Site4:AA1:BB2:CC3	0.0	0	0.00	240
Site4:AA1:BB2:CC4	0.0	0	0.00	240
Site4:AA1:BB3:CC1	0.0	0	0.00	240
Site4:AA1:BB3:CC2	0.0	0	0.00	240
Site4:AA1:BB3:CC3	0.0	0	0.00	240
Site4:AA1:BB3:CC4	0.0	0	0.00	240
Site4:AA1:BB4:CC1	0.0	0	0.00	240
Site4:AA1:BB4:CC2	0.0	0	0.00	240
Site4:AA1:BB4:CC3	0.0	0	0.00	240
Site4:AA1:BB4:CC4	0.0	0	0.00	240
Site4:AA1:BB5:CC1	0.0	0	0.00	240
Site4:AA1:BB5:CC2	0.0	0	0.00	240
Site4:AA1:BB5:CC3	0.0	0	0.00	240
Site4:AA1:BB5:CC4	0.0	0	0.00	240
Site4:AA2:BB1:CC1	0.0	0	0.00	240
Site4:AA2:BB1:CC2	0.0	0	0.00	240
Site4:AA2:BB1:CC3	0.0	0	0.00	240
Site4:AA2:BB1:CC4	0.0	0	0.00	240

```
Site4:AA2:BB2:CC1          0.0         0       0.00 240
Site4:AA2:BB2:CC2          0.0         0       0.00 240
Site4:AA2:BB2:CC3          0.0         0       0.00 240
Site4:AA2:BB2:CC4          0.0         0       0.00 240
Site4:AA2:BB3:CC1          0.0         0       0.00 240
Site4:AA2:BB3:CC2          0.0         0       0.00 240
Site4:AA2:BB3:CC3          0.0         0       0.00 240
Site4:AA2:BB3:CC4          0.0         0       0.00 240
Site4:AA2:BB4:CC1          0.0         0       0.00 240
Site4:AA2:BB4:CC2          0.0         0       0.00 240
Site4:AA2:BB4:CC3          0.0         0       0.00 240
Site4:AA2:BB4:CC4          0.0         0       0.00 240
Site4:AA2:BB5:CC1          0.0         0       0.00 240
Site4:AA2:BB5:CC2          0.0         0       0.00 240
Site4:AA2:BB5:CC3          0.0         0       0.00 240
Site4:AA2:BB5:CC4          0.0         0       0.00 240
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(74) 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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)            98         0             0
P1                     -2         0             0
P2                      0         0             0
column1               -10         0             0
column2               -20         0             0
column3                 0         0             0
column4               -13         0             0
column5                 0         0             0
```

P1:column1	12	0	0
P1:column2	12	0	0
P1:column3	1	0	0
P1:column4	13	0	0
P1:column5	0	0	0
P2:column1	0	0	0
P2:column2	0	0	0
P2:column3	0	0	0
P2:column4	0	0	0
P2:column5	0	0	0
R1	-9	0	0
R2	1	0	0
R3	-15	0	0
R4	-1	0	0
R5	0	0	0
P1:R1	12	0	0
P1:R2	2	0	0
P1:R3	-3	0	0
P1:R4	3	0	0
P1:R5	0	0	0
P2:R1	0	0	0
P2:R2	0	0	0
P2:R3	0	0	0
P2:R4	0	0	0
P2:R5	0	0	0
column1:R1	19	0	0
column1:R2	10	0	0
column1:R3	28	0	0
column1:R4	1	0	0
column1:R5	0	0	0
column2:R1	21	0	0
column2:R2	7	0	0
column2:R3	33	0	0
column2:R4	20	0	0
column2:R5	0	0	0
column3:R1	7	0	0
column3:R2	-6	0	0
column3:R3	12	0	0
column3:R4	-5	0	0
column3:R5	0	0	0
column4:R1	23	0	0
column4:R2	1	0	0
column4:R3	13	0	0
column4:R4	14	0	0
column4:R5	0	0	0
column5:R1	0	0	0
column5:R2	0	0	0
column5:R3	0	0	0

column5:R4	0	0	0
column5:R5	0	0	0
P1:column1:R1	-40	0	0
P1:column1:R2	-12	0	0
P1:column1:R3	-5	0	0
P1:column1:R4	-2	0	0
P1:column1:R5	0	0	0
P1:column2:R1	-23	0	0
P1:column2:R2	-8	0	0
P1:column2:R3	-10	0	0
P1:column2:R4	-11	0	0
P1:column2:R5	0	0	0
P1:column3:R1	-9	0	0
P1:column3:R2	1	0	0
P1:column3:R3	8	0	0
P1:column3:R4	-6	0	0
P1:column3:R5	0	0	0
P1:column4:R1	-34	0	0
P1:column4:R2	0	0	0
P1:column4:R3	8	0	0
P1:column4:R4	-18	0	0
P1:column4:R5	0	0	0
P1:column5:R1	0	0	0
P1:column5:R2	0	0	0
P1:column5:R3	0	0	0
P1:column5:R4	0	0	0
P1:column5:R5	0	0	0
P2:column1:R1	0	0	0
P2:column1:R2	0	0	0
P2:column1:R3	0	0	0
P2:column1:R4	0	0	0
P2:column1:R5	0	0	0
P2:column2:R1	0	0	0
P2:column2:R2	0	0	0
P2:column2:R3	0	0	0
P2:column2:R4	0	0	0
P2:column2:R5	0	0	0
P2:column3:R1	0	0	0
P2:column3:R2	0	0	0
P2:column3:R3	0	0	0
P2:column3:R4	0	0	0
P2:column3:R5	0	0	0
P2:column4:R1	0	0	0
P2:column4:R2	0	0	0
P2:column4:R3	0	0	0
P2:column4:R4	0	0	0
P2:column4:R5	0	0	0
P2:column5:R1	0	0	0

P2:column5:R2	0	0	0
P2:column5:R3	0	0	0
P2:column5:R4	0	0	0
P2:column5:R5	0	0	0
S1	1	0	0
S2	-2	0	0
S3	-5	0	0
S4	0	0	0
P1:S1	1	0	0
P1:S2	-1	0	0
P1:S3	7	0	0
P1:S4	0	0	0
P2:S1	0	0	0
P2:S2	0	0	0
P2:S3	0	0	0
P2:S4	0	0	0
column1:S1	9	0	0
column1:S2	1	0	0
column1:S3	16	0	0
column1:S4	0	0	0
column2:S1	-2	0	0
column2:S2	4	0	0
column2:S3	6	0	0
column2:S4	0	0	0
column3:S1	-3	0	0
column3:S2	-8	0	0
column3:S3	5	0	0
column3:S4	0	0	0
column4:S1	2	0	0
column4:S2	6	0	0
column4:S3	7	0	0
column4:S4	0	0	0
column5:S1	0	0	0
column5:S2	0	0	0
column5:S3	0	0	0
column5:S4	0	0	0
P1:column1:S1	-12	0	0
P1:column1:S2	2	0	0
P1:column1:S3	-17	0	0
P1:column1:S4	0	0	0
P1:column2:S1	4	0	0
P1:column2:S2	9	0	0
P1:column2:S3	3	0	0
P1:column2:S4	0	0	0
P1:column3:S1	3	0	0
P1:column3:S2	14	0	0
P1:column3:S3	-5	0	0
P1:column3:S4	0	0	0

P1:column4:S1	-5	0	0
P1:column4:S2	-4	0	0
P1:column4:S3	-10	0	0
P1:column4:S4	0	0	0
P1:column5:S1	0	0	0
P1:column5:S2	0	0	0
P1:column5:S3	0	0	0
P1:column5:S4	0	0	0
P2:column1:S1	0	0	0
P2:column1:S2	0	0	0
P2:column1:S3	0	0	0
P2:column1:S4	0	0	0
P2:column2:S1	0	0	0
P2:column2:S2	0	0	0
P2:column2:S3	0	0	0
P2:column2:S4	0	0	0
P2:column3:S1	0	0	0
P2:column3:S2	0	0	0
P2:column3:S3	0	0	0
P2:column3:S4	0	0	0
P2:column4:S1	0	0	0
P2:column4:S2	0	0	0
P2:column4:S3	0	0	0
P2:column4:S4	0	0	0
P2:column5:S1	0	0	0
P2:column5:S2	0	0	0
P2:column5:S3	0	0	0
P2:column5:S4	0	0	0
R1:S1	8	0	0
R1:S2	11	0	0
R1:S3	15	0	0
R1:S4	0	0	0
R2:S1	-1	0	0
R2:S2	-1	0	0
R2:S3	4	0	0
R2:S4	0	0	0
R3:S1	-4	0	0
R3:S2	0	0	0
R3:S3	4	0	0
R3:S4	0	0	0
R4:S1	-8	0	0
R4:S2	-5	0	0
R4:S3	-2	0	0
R4:S4	0	0	0
R5:S1	0	0	0
R5:S2	0	0	0
R5:S3	0	0	0
R5:S4	0	0	0

column1:R1:S1	-17	0	0
column1:R1:S2	-9	0	0
column1:R1:S3	-27	0	0
column1:R1:S4	0	0	0
column1:R2:S1	-14	0	0
column1:R2:S2	-8	0	0
column1:R2:S3	-16	0	0
column1:R2:S4	0	0	0
column1:R3:S1	-7	0	0
column1:R3:S2	1	0	0
column1:R3:S3	-17	0	0
column1:R3:S4	0	0	0
column1:R4:S1	-10	0	0
column1:R4:S2	3	0	0
column1:R4:S3	-19	0	0
column1:R4:S4	0	0	0
column1:R5:S1	0	0	0
column1:R5:S2	0	0	0
column1:R5:S3	0	0	0
column1:R5:S4	0	0	0
column2:R1:S1	2	0	0
column2:R1:S2	-4	0	0
column2:R1:S3	-11	0	0
column2:R1:S4	0	0	0
column2:R2:S1	4	0	0
column2:R2:S2	1	0	0
column2:R2:S3	-4	0	0
column2:R2:S4	0	0	0
column2:R3:S1	6	0	0
column2:R3:S2	0	0	0
column2:R3:S3	-10	0	0
column2:R3:S4	0	0	0
column2:R4:S1	11	0	0
column2:R4:S2	3	0	0
column2:R4:S3	-11	0	0
column2:R4:S4	0	0	0
column2:R5:S1	0	0	0
column2:R5:S2	0	0	0
column2:R5:S3	0	0	0
column2:R5:S4	0	0	0
column3:R1:S1	-5	0	0
column3:R1:S2	1	0	0
column3:R1:S3	-17	0	0
column3:R1:S4	0	0	0
column3:R2:S1	1	0	0
column3:R2:S2	10	0	0
column3:R2:S3	-7	0	0
column3:R2:S4	0	0	0

column3:R3:S1	8	0	0
column3:R3:S2	11	0	0
column3:R3:S3	0	0	0
column3:R3:S4	0	0	0
column3:R4:S1	17	0	0
column3:R4:S2	22	0	0
column3:R4:S3	8	0	0
column3:R4:S4	0	0	0
column3:R5:S1	0	0	0
column3:R5:S2	0	0	0
column3:R5:S3	0	0	0
column3:R5:S4	0	0	0
column4:R1:S1	-13	0	0
column4:R1:S2	-15	0	0
column4:R1:S3	-18	0	0
column4:R1:S4	0	0	0
column4:R2:S1	1	0	0
column4:R2:S2	5	0	0
column4:R2:S3	6	0	0
column4:R2:S4	0	0	0
column4:R3:S1	4	0	0
column4:R3:S2	1	0	0
column4:R3:S3	-2	0	0
column4:R3:S4	0	0	0
column4:R4:S1	-4	0	0
column4:R4:S2	2	0	0
column4:R4:S3	-1	0	0
column4:R4:S4	0	0	0
column4:R5:S1	0	0	0
column4:R5:S2	0	0	0
column4:R5:S3	0	0	0
column4:R5:S4	0	0	0
column5:R1:S1	0	0	0
column5:R1:S2	0	0	0
column5:R1:S3	0	0	0
column5:R1:S4	0	0	0
column5:R2:S1	0	0	0
column5:R2:S2	0	0	0
column5:R2:S3	0	0	0
column5:R2:S4	0	0	0
column5:R3:S1	0	0	0
column5:R3:S2	0	0	0
column5:R3:S3	0	0	0
column5:R3:S4	0	0	0
column5:R4:S1	0	0	0
column5:R4:S2	0	0	0
column5:R4:S3	0	0	0
column5:R4:S4	0	0	0

column5:R5:S1	0	0	0
column5:R5:S2	0	0	0
column5:R5:S3	0	0	0
column5:R5:S4	0	0	0
P1:R1:S1	-7	0	0
P1:R1:S2	0	0	0
P1:R1:S3	-18	0	0
P1:R1:S4	0	0	0
P1:R2:S1	-2	0	0
P1:R2:S2	3	0	0
P1:R2:S3	-10	0	0
P1:R2:S4	0	0	0
P1:R3:S1	12	0	0
P1:R3:S2	10	0	0
P1:R3:S3	-6	0	0
P1:R3:S4	0	0	0
P1:R4:S1	7	0	0
P1:R4:S2	5	0	0
P1:R4:S3	0	0	0
P1:R4:S4	0	0	0
P1:R5:S1	0	0	0
P1:R5:S2	0	0	0
P1:R5:S3	0	0	0
P1:R5:S4	0	0	0
P2:R1:S1	0	0	0
P2:R1:S2	0	0	0
P2:R1:S3	0	0	0
P2:R1:S4	0	0	0
P2:R2:S1	0	0	0
P2:R2:S2	0	0	0
P2:R2:S3	0	0	0
P2:R2:S4	0	0	0
P2:R3:S1	0	0	0
P2:R3:S2	0	0	0
P2:R3:S3	0	0	0
P2:R3:S4	0	0	0
P2:R4:S1	0	0	0
P2:R4:S2	0	0	0
P2:R4:S3	0	0	0
P2:R4:S4	0	0	0
P2:R5:S1	0	0	0
P2:R5:S2	0	0	0
P2:R5:S3	0	0	0
P2:R5:S4	0	0	0
P1:column1:R1:S1	17	0	0
P1:column1:R1:S2	-1	0	0
P1:column1:R1:S3	33	0	0
P1:column1:R1:S4	0	0	0

P1:column1:R2:S1	14	0	0
P1:column1:R2:S2	4	0	0
P1:column1:R2:S3	20	0	0
P1:column1:R2:S4	0	0	0
P1:column1:R3:S1	-2	0	0
P1:column1:R3:S2	-16	0	0
P1:column1:R3:S3	16	0	0
P1:column1:R3:S4	0	0	0
P1:column1:R4:S1	9	0	0
P1:column1:R4:S2	-14	0	0
P1:column1:R4:S3	19	0	0
P1:column1:R4:S4	0	0	0
P1:column1:R5:S1	0	0	0
P1:column1:R5:S2	0	0	0
P1:column1:R5:S3	0	0	0
P1:column1:R5:S4	0	0	0
P1:column2:R1:S1	2	0	0
P1:column2:R1:S2	-8	0	0
P1:column2:R1:S3	11	0	0
P1:column2:R1:S4	0	0	0
P1:column2:R2:S1	-5	0	0
P1:column2:R2:S2	-13	0	0
P1:column2:R2:S3	-1	0	0
P1:column2:R2:S4	0	0	0
P1:column2:R3:S1	-15	0	0
P1:column2:R3:S2	-14	0	0
P1:column2:R3:S3	6	0	0
P1:column2:R3:S4	0	0	0
P1:column2:R4:S1	-13	0	0
P1:column2:R4:S2	-12	0	0
P1:column2:R4:S3	1	0	0
P1:column2:R4:S4	0	0	0
P1:column2:R5:S1	0	0	0
P1:column2:R5:S2	0	0	0
P1:column2:R5:S3	0	0	0
P1:column2:R5:S4	0	0	0
P1:column3:R1:S1	3	0	0
P1:column3:R1:S2	-18	0	0
P1:column3:R1:S3	17	0	0
P1:column3:R1:S4	0	0	0
P1:column3:R2:S1	-10	0	0
P1:column3:R2:S2	-22	0	0
P1:column3:R2:S3	14	0	0
P1:column3:R2:S4	0	0	0
P1:column3:R3:S1	-19	0	0
P1:column3:R3:S2	-26	0	0
P1:column3:R3:S3	0	0	0
P1:column3:R3:S4	0	0	0

P1:column3:R4:S1	-19	0	0
P1:column3:R4:S2	-25	0	0
P1:column3:R4:S3	-8	0	0
P1:column3:R4:S4	0	0	0
P1:column3:R5:S1	0	0	0
P1:column3:R5:S2	0	0	0
P1:column3:R5:S3	0	0	0
P1:column3:R5:S4	0	0	0
P1:column4:R1:S1	12	0	0
P1:column4:R1:S2	14	0	0
P1:column4:R1:S3	30	0	0
P1:column4:R1:S4	0	0	0
P1:column4:R2:S1	5	0	0
P1:column4:R2:S2	-7	0	0
P1:column4:R2:S3	0	0	0
P1:column4:R2:S4	0	0	0
P1:column4:R3:S1	-15	0	0
P1:column4:R3:S2	-11	0	0
P1:column4:R3:S3	3	0	0
P1:column4:R3:S4	0	0	0
P1:column4:R4:S1	7	0	0
P1:column4:R4:S2	2	0	0
P1:column4:R4:S3	9	0	0
P1:column4:R4:S4	0	0	0
P1:column4:R5:S1	0	0	0
P1:column4:R5:S2	0	0	0
P1:column4:R5:S3	0	0	0
P1:column4:R5:S4	0	0	0
P1:column5:R1:S1	0	0	0
P1:column5:R1:S2	0	0	0
P1:column5:R1:S3	0	0	0
P1:column5:R1:S4	0	0	0
P1:column5:R2:S1	0	0	0
P1:column5:R2:S2	0	0	0
P1:column5:R2:S3	0	0	0
P1:column5:R2:S4	0	0	0
P1:column5:R3:S1	0	0	0
P1:column5:R3:S2	0	0	0
P1:column5:R3:S3	0	0	0
P1:column5:R3:S4	0	0	0
P1:column5:R4:S1	0	0	0
P1:column5:R4:S2	0	0	0
P1:column5:R4:S3	0	0	0
P1:column5:R4:S4	0	0	0
P1:column5:R5:S1	0	0	0
P1:column5:R5:S2	0	0	0
P1:column5:R5:S3	0	0	0
P1:column5:R5:S4	0	0	0

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

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

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

(75) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)         88         0             0
row1                10         0             0
row2                10         0             0
row3               -10         0             0
row4                -3         0             0
row5                 0         0             0
R1                   2         0             0
R2                  11         0             0
R3                  -5         0             0
R4                   4         0             0
R5                   0         0             0
P1                  10         0             0
P2                   0         0             0
S1                  10         0             0
S2                  -1         0             0
S3                  11         0             0
S4                   0         0             0
R1:S1               -1         0             0
R1:S2               10         0             0
R1:S3               -6         0             0
R1:S4                0         0             0
R2:S1              -10         0             0
R2:S2               -2         0             0
R2:S3              -12         0             0
R2:S4                0         0             0
R3:S1               -7         0             0
R3:S2                6         0             0
R3:S3               -7         0             0
R3:S4                0         0             0
R4:S1               -3         0             0
R4:S2                8         0             0
R4:S3               -5         0             0
R4:S4                0         0             0
```

R5:S1	0	0	0
R5:S2	0	0	0
R5:S3	0	0	0
R5:S4	0	0	0
row1:P1	-11	0	0
row1:P2	0	0	0
row2:P1	-12	0	0
row2:P2	0	0	0
row3:P1	0	0	0
row3:P2	0	0	0
row4:P1	1	0	0
row4:P2	0	0	0
row5:P1	0	0	0
row5:P2	0	0	0
R1:P1	-11	0	0
R1:P2	0	0	0
R2:P1	-10	0	0
R2:P2	0	0	0
R3:P1	6	0	0
R3:P2	0	0	0
R4:P1	-14	0	0
R4:P2	0	0	0
R5:P1	0	0	0
R5:P2	0	0	0
row1:R1:P1	11	0	0
row1:R1:P2	-11	0	0
row1:R2:P1	2	0	0
row1:R2:P2	-22	0	0
row1:R3:P1	5	0	0
row1:R3:P2	8	0	0
row1:R4:P1	12	0	0
row1:R4:P2	-5	0	0
row1:R5:P1	0	0	0
row1:R5:P2	0	0	0
row2:R1:P1	11	0	0
row2:R1:P2	-4	0	0
row2:R2:P1	2	0	0
row2:R2:P2	-10	0	0
row2:R3:P1	-4	0	0
row2:R3:P2	3	0	0
row2:R4:P1	8	0	0
row2:R4:P2	-4	0	0
row2:R5:P1	0	0	0
row2:R5:P2	0	0	0
row3:R1:P1	9	0	0
row3:R1:P2	19	0	0
row3:R2:P1	6	0	0
row3:R2:P2	4	0	0

row3:R3:P1	-11	0	0
row3:R3:P2	10	0	0
row3:R4:P1	21	0	0
row3:R4:P2	6	0	0
row3:R5:P1	0	0	0
row3:R5:P2	0	0	0
row4:R1:P1	-7	0	0
row4:R1:P2	11	0	0
row4:R2:P1	-7	0	0
row4:R2:P2	-10	0	0
row4:R3:P1	2	0	0
row4:R3:P2	15	0	0
row4:R4:P1	12	0	0
row4:R4:P2	8	0	0
row4:R5:P1	0	0	0
row4:R5:P2	0	0	0
row5:R1:P1	0	0	0
row5:R1:P2	0	0	0
row5:R2:P1	0	0	0
row5:R2:P2	0	0	0
row5:R3:P1	0	0	0
row5:R3:P2	0	0	0
row5:R4:P1	0	0	0
row5:R4:P2	0	0	0
row5:R5:P1	0	0	0
row5:R5:P2	0	0	0
P1:S1	-11	0	0
P1:S2	1	0	0
P1:S3	-10	0	0
P1:S4	0	0	0
P2:S1	0	0	0
P2:S2	0	0	0
P2:S3	0	0	0
P2:S4	0	0	0
row1:P1:S1	3	0	0
row1:P1:S2	3	0	0
row1:P1:S3	1	0	0
row1:P1:S4	0	0	0
row1:P2:S1	-12	0	0
row1:P2:S2	-9	0	0
row1:P2:S3	-11	0	0
row1:P2:S4	0	0	0
row2:P1:S1	3	0	0
row2:P1:S2	-3	0	0
row2:P1:S3	1	0	0
row2:P1:S4	0	0	0
row2:P2:S1	-9	0	0
row2:P2:S2	-1	0	0

row2:P2:S3	-16	0	0
row2:P2:S4	0	0	0
row3:P1:S1	5	0	0
row3:P1:S2	10	0	0
row3:P1:S3	10	0	0
row3:P1:S4	0	0	0
row3:P2:S1	-11	0	0
row3:P2:S2	3	0	0
row3:P2:S3	-10	0	0
row3:P2:S4	0	0	0
row4:P1:S1	0	0	0
row4:P1:S2	-1	0	0
row4:P1:S3	-2	0	0
row4:P1:S4	0	0	0
row4:P2:S1	-7	0	0
row4:P2:S2	5	0	0
row4:P2:S3	-9	0	0
row4:P2:S4	0	0	0
row5:P1:S1	0	0	0
row5:P1:S2	0	0	0
row5:P1:S3	0	0	0
row5:P1:S4	0	0	0
row5:P2:S1	0	0	0
row5:P2:S2	0	0	0
row5:P2:S3	0	0	0
row5:P2:S4	0	0	0
R1:P1:S1	11	0	0
R1:P1:S2	-1	0	0
R1:P1:S3	13	0	0
R1:P1:S4	0	0	0
R1:P2:S1	0	0	0
R1:P2:S2	0	0	0
R1:P2:S3	0	0	0
R1:P2:S4	0	0	0
R2:P1:S1	10	0	0
R2:P1:S2	1	0	0
R2:P1:S3	7	0	0
R2:P1:S4	0	0	0
R2:P2:S1	0	0	0
R2:P2:S2	0	0	0
R2:P2:S3	0	0	0
R2:P2:S4	0	0	0
R3:P1:S1	4	0	0
R3:P1:S2	-7	0	0
R3:P1:S3	4	0	0
R3:P1:S4	0	0	0
R3:P2:S1	0	0	0
R3:P2:S2	0	0	0

R3:P2:S3	0	0	0
R3:P2:S4	0	0	0
R4:P1:S1	3	0	0
R4:P1:S2	-8	0	0
R4:P1:S3	4	0	0
R4:P1:S4	0	0	0
R4:P2:S1	0	0	0
R4:P2:S2	0	0	0
R4:P2:S3	0	0	0
R4:P2:S4	0	0	0
R5:P1:S1	0	0	0
R5:P1:S2	0	0	0
R5:P1:S3	0	0	0
R5:P1:S4	0	0	0
R5:P2:S1	0	0	0
R5:P2:S2	0	0	0
R5:P2:S3	0	0	0
R5:P2:S4	0	0	0
row1:R1:P1:S1	-9	0	0
row1:R1:P1:S2	-4	0	0
row1:R1:P1:S3	-10	0	0
row1:R1:P1:S4	0	0	0
row1:R1:P2:S1	12	0	0
row1:R1:P2:S2	9	0	0
row1:R1:P2:S3	16	0	0
row1:R1:P2:S4	0	0	0
row1:R2:P1:S1	0	0	0
row1:R2:P1:S2	-3	0	0
row1:R2:P1:S3	2	0	0
row1:R2:P1:S4	0	0	0
row1:R2:P2:S1	15	0	0
row1:R2:P2:S2	20	0	0
row1:R2:P2:S3	24	0	0
row1:R2:P2:S4	0	0	0
row1:R3:P1:S1	-1	0	0
row1:R3:P1:S2	-7	0	0
row1:R3:P1:S3	-1	0	0
row1:R3:P1:S4	0	0	0
row1:R3:P2:S1	8	0	0
row1:R3:P2:S2	4	0	0
row1:R3:P2:S3	5	0	0
row1:R3:P2:S4	0	0	0
row1:R4:P1:S1	-1	0	0
row1:R4:P1:S2	-2	0	0
row1:R4:P1:S3	-2	0	0
row1:R4:P1:S4	0	0	0
row1:R4:P2:S1	7	0	0
row1:R4:P2:S2	2	0	0

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

row2:R5:P2:S3	0	0	0
row2:R5:P2:S4	0	0	0
row3:R1:P1:S1	-15	0	0
row3:R1:P1:S2	-10	0	0
row3:R1:P1:S3	-10	0	0
row3:R1:P1:S4	0	0	0
row3:R1:P2:S1	0	0	0
row3:R1:P2:S2	-12	0	0
row3:R1:P2:S3	4	0	0
row3:R1:P2:S4	0	0	0
row3:R2:P1:S1	-14	0	0
row3:R2:P1:S2	-16	0	0
row3:R2:P1:S3	-3	0	0
row3:R2:P1:S4	0	0	0
row3:R2:P2:S1	9	0	0
row3:R2:P2:S2	-1	0	0
row3:R2:P2:S3	8	0	0
row3:R2:P2:S4	0	0	0
row3:R3:P1:S1	9	0	0
row3:R3:P1:S2	-2	0	0
row3:R3:P1:S3	-8	0	0
row3:R3:P1:S4	0	0	0
row3:R3:P2:S1	5	0	0
row3:R3:P2:S2	-10	0	0
row3:R3:P2:S3	5	0	0
row3:R3:P2:S4	0	0	0
row3:R4:P1:S1	-7	0	0
row3:R4:P1:S2	-21	0	0
row3:R4:P1:S3	-11	0	0
row3:R4:P1:S4	0	0	0
row3:R4:P2:S1	-4	0	0
row3:R4:P2:S2	-13	0	0
row3:R4:P2:S3	-6	0	0
row3:R4:P2:S4	0	0	0
row3:R5:P1:S1	0	0	0
row3:R5:P1:S2	0	0	0
row3:R5:P1:S3	0	0	0
row3:R5:P1:S4	0	0	0
row3:R5:P2:S1	0	0	0
row3:R5:P2:S2	0	0	0
row3:R5:P2:S3	0	0	0
row3:R5:P2:S4	0	0	0
row4:R1:P1:S1	-9	0	0
row4:R1:P1:S2	-7	0	0
row4:R1:P1:S3	-2	0	0
row4:R1:P1:S4	0	0	0
row4:R1:P2:S1	-1	0	0
row4:R1:P2:S2	-13	0	0

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

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

(76) 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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   85.875         0     8.1490 45 10.5381 9.814e-14 ***
rep1          20.750         0     9.4097 45  2.2052 0.0325933 *
rep2         -14.000         0     9.4097 45 -1.4878 0.1437694
rep3          12.250         0     9.4097 45  1.3019 0.1995913
rep4         -23.750         0     9.4097 45 -2.5240 0.0152008 *
rep5           9.500         0     9.4097 45  1.0096 0.3180846
rep6           0.000         0     0.0000 45
var1         -22.500         0    11.5244 45 -1.9524 0.0571318 .
var2         -20.125         0    11.5244 45 -1.7463 0.0875843 .
var3           0.000         0     0.0000 45
rep1:var1     32.750         0    13.3073 45  2.4611 0.0177533 *
```

```
rep1:var2     22.250         0    13.3073 45  1.6720 0.1014609
rep1:var3      0.000         0     0.0000 45
rep2:var1     16.000         0    13.3073 45  1.2024 0.2355164
rep2:var2     31.750         0    13.3073 45  2.3859 0.0213053 *
rep2:var3      0.000         0     0.0000 45
rep3:var1    -14.500         0    13.3073 45 -1.0896 0.2816769
rep3:var2     10.750         0    13.3073 45  0.8078 0.4234387
rep3:var3      0.000         0     0.0000 45
rep4:var1     26.250         0    13.3073 45  1.9726 0.0547034 .
rep4:var2     29.000         0    13.3073 45  2.1793 0.0345870 *
rep4:var3      0.000         0     0.0000 45
rep5:var1    -16.500         0    13.3073 45 -1.2399 0.2214304
rep5:var2    -13.000         0    13.3073 45 -0.9769 0.3338365
rep5:var3      0.000         0     0.0000 45
rep6:var1      0.000         0     0.0000 45
rep6:var2      0.000         0     0.0000 45
rep6:var3      0.000         0     0.0000 45
nit1          21.833         0     7.6830 45  2.8418 0.0067187 **
nit2          30.500         0     7.6830 45  3.9698 0.0002562 ***
nit3          40.167         0     7.6830 45  5.2280 4.290e-06 ***
nit4           0.000         0     0.0000 45
var1:nit1     -3.667         0    10.8653 45 -0.3375 0.7373358
var1:nit2      8.833         0    10.8653 45  0.8130 0.4205085
var1:nit3      6.833         0    10.8653 45  0.6289 0.5325868
var1:nit4      0.000         0     0.0000 45
var2:nit1     -3.333         0    10.8653 45 -0.3068 0.7604214
var2:nit2      4.167         0    10.8653 45  0.3835 0.7031679
var2:nit3      4.667         0    10.8653 45  0.4295 0.6696087
var2:nit4      0.000         0     0.0000 45
var3:nit1      0.000         0     0.0000 45
var3:nit2      0.000         0     0.0000 45
var3:nit3      0.000         0     0.0000 45
var3:nit4      0.000         0     0.0000 45
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(77) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   78.195         0     9.4953 34  8.2351 1.311e-09 ***
rep1          22.320         0    11.2116 34  1.9908 0.0545890 .
rep2          -9.827         0     9.9492 34 -0.9877 0.3302882
rep3          16.942         0    10.2780 34  1.6484 0.1084805
rep4         -24.656         0    10.6082 34 -2.3242 0.0262249 *
rep5          16.807         0    10.1264 34  1.6597 0.1061670
rep6           0.000         0     0.0000 34
var1         -23.629         0    12.0789 34 -1.9562 0.0586954 .
var2         -16.007         0    11.9933 34 -1.3346 0.1908629
```

```
var3           0.000         0     0.0000 34
rep1:var1     39.666         0    14.2816 34  2.7775 0.0088510 **
rep1:var2     24.703         0    14.1608 34  1.7445 0.0901108 .
rep1:var3      0.000         0     0.0000 34
rep2:var1      8.452         0    13.6932 34  0.6172 0.5411868
rep2:var2     35.142         0    13.4753 34  2.6079 0.0134358 *
rep2:var3      0.000         0     0.0000 34
rep3:var1    -15.615         0    15.0163 34 -1.0399 0.3057408
rep3:var2      5.214         0    14.8157 34  0.3519 0.7270537
rep3:var3      0.000         0     0.0000 34
rep4:var1     32.022         0    14.0835 34  2.2737 0.0294152 *
rep4:var2     32.597         0    14.2110 34  2.2938 0.0281056 *
rep4:var3      0.000         0     0.0000 34
rep5:var1    -29.657         0    14.2036 34 -2.0880 0.0443605 *
rep5:var2    -20.826         0    14.0023 34 -1.4873 0.1461435
rep5:var3      0.000         0     0.0000 34
rep6:var1      0.000         0     0.0000 34
rep6:var2      0.000         0     0.0000 34
rep6:var3      0.000         0     0.0000 34
nit1          20.904         0     6.8122 34  3.0686 0.0042045 **
nit2          25.790         0     7.9006 34  3.2643 0.0025052 **
nit3          43.888         0     8.4402 34  5.1999 9.452e-06 ***
nit4           0.000         0     0.0000 34
var1:nit1      1.136         0     9.7632 34  0.1164 0.9080219
var1:nit2     14.232         0    10.2550 34  1.3878 0.1742328
var1:nit3     -3.260         0    11.0914 34 -0.2939 0.7705879
var1:nit4      0.000         0     0.0000 34
var2:nit1     -1.428         0     9.1191 34 -0.1566 0.8764628
var2:nit2      5.784         0    11.0936 34  0.5214 0.6054692
var2:nit3     -6.461         0    11.3313 34 -0.5702 0.5722670
var2:nit4      0.000         0     0.0000 34
var3:nit1      0.000         0     0.0000 34
var3:nit2      0.000         0     0.0000 34
var3:nit3      0.000         0     0.0000 34
var3:nit4      0.000         0     0.0000 34
row1           1.613         0     9.9332 34  0.1624 0.8719639
row2           0.000         0     0.0000 34
row3         -10.016         0     8.3602 34 -1.1980 0.2391928
row4           0.000         0     0.0000 34
row5          -7.727         0     8.5301 34 -0.9059 0.3713775
row6           0.000         0     0.0000 34
row7          -3.594         0     8.6347 34 -0.4162 0.6798797
row8           0.000         0     0.0000 34
row9          13.706         0     8.4538 34  1.6213 0.1141882
row10          0.000         0     0.0000 34
row11        -14.812         0     8.7800 34 -1.6870 0.1007506
row12          0.000         0     0.0000 34
row13          2.006         0     8.3976 34  0.2389 0.8126419
```

```
row14          0.000         0     0.0000 34
row15         -4.632         0     8.4677 34 -0.5470 0.5879538
row16          0.000         0     0.0000 34
row17         -0.198         0     8.7515 34 -0.0226 0.9820790
row18          0.000         0     0.0000 34
col1          11.566         0     3.9157 34  2.9538 0.0056610 **
col2           0.000         0     0.0000 34
col3          16.517         0     4.1675 34  3.9633 0.0003597 ***
col4           0.000         0     0.0000 34
---
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

(78) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)             8         0             0
P1                     -2         0             0
P2                      0         0             0
column1                 0         0             0
column2                 0         0             0
column3                 0         0             0
column4                -3         0             0
column5                 0         0             0
P1:column1              2         0             0
P1:column2              2         0             0
P1:column3              1         0             0
P1:column4              3         0             0
P1:column5              0         0             0
P2:column1              0         0             0
P2:column2              0         0             0
P2:column3              0         0             0
P2:column4              0         0             0
P2:column5              0         0             0
R1                      1         0             0
R2                      1         0             0
R3                     -5         0             0
R4                     -1         0             0
R5                      0         0             0
P1:R1                   2         0             0
P1:R2                   2         0             0
P1:R3                   7         0             0
P1:R4                   3         0             0
P1:R5                   0         0             0
P2:R1                   0         0             0
P2:R2                   0         0             0
P2:R3                   0         0             0
P2:R4                   0         0             0
P2:R5                   0         0             0
column1:R1             -1         0             0
column1:R2              0         0             0
column1:R3              8         0             0
column1:R4              1         0             0
column1:R5              0         0             0
column2:R1             -9         0             0
column2:R2             -3         0             0
```

column2:R3	3	0	0
column2:R4	0	0	0
column2:R5	0	0	0
column3:R1	-3	0	0
column3:R2	-6	0	0
column3:R3	2	0	0
column3:R4	-5	0	0
column3:R5	0	0	0
column4:R1	3	0	0
column4:R2	1	0	0
column4:R3	3	0	0
column4:R4	4	0	0
column4:R5	0	0	0
column5:R1	0	0	0
column5:R2	0	0	0
column5:R3	0	0	0
column5:R4	0	0	0
column5:R5	0	0	0
P1:column1:R1	-10	0	0
P1:column1:R2	-2	0	0
P1:column1:R3	-5	0	0
P1:column1:R4	-2	0	0
P1:column1:R5	0	0	0
P1:column2:R1	7	0	0
P1:column2:R2	-8	0	0
P1:column2:R3	-10	0	0
P1:column2:R4	-1	0	0
P1:column2:R5	0	0	0
P1:column3:R1	1	0	0
P1:column3:R2	1	0	0
P1:column3:R3	-2	0	0
P1:column3:R4	4	0	0
P1:column3:R5	0	0	0
P1:column4:R1	-4	0	0
P1:column4:R2	0	0	0
P1:column4:R3	-2	0	0
P1:column4:R4	-8	0	0
P1:column4:R5	0	0	0
P1:column5:R1	0	0	0
P1:column5:R2	0	0	0
P1:column5:R3	0	0	0
P1:column5:R4	0	0	0
P1:column5:R5	0	0	0
P2:column1:R1	0	0	0
P2:column1:R2	0	0	0
P2:column1:R3	0	0	0
P2:column1:R4	0	0	0
P2:column1:R5	0	0	0

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

column5:S1	0	0	0
column5:S2	0	0	0
column5:S3	0	0	0
column5:S4	0	0	0
P1:column1:S1	-2	0	0
P1:column1:S2	2	0	0
P1:column1:S3	-7	0	0
P1:column1:S4	0	0	0
P1:column2:S1	-6	0	0
P1:column2:S2	9	0	0
P1:column2:S3	-7	0	0
P1:column2:S4	0	0	0
P1:column3:S1	3	0	0
P1:column3:S2	4	0	0
P1:column3:S3	-5	0	0
P1:column3:S4	0	0	0
P1:column4:S1	-5	0	0
P1:column4:S2	-4	0	0
P1:column4:S3	-10	0	0
P1:column4:S4	0	0	0
P1:column5:S1	0	0	0
P1:column5:S2	0	0	0
P1:column5:S3	0	0	0
P1:column5:S4	0	0	0
P2:column1:S1	0	0	0
P2:column1:S2	0	0	0
P2:column1:S3	0	0	0
P2:column1:S4	0	0	0
P2:column2:S1	0	0	0
P2:column2:S2	0	0	0
P2:column2:S3	0	0	0
P2:column2:S4	0	0	0
P2:column3:S1	0	0	0
P2:column3:S2	0	0	0
P2:column3:S3	0	0	0
P2:column3:S4	0	0	0
P2:column4:S1	0	0	0
P2:column4:S2	0	0	0
P2:column4:S3	0	0	0
P2:column4:S4	0	0	0
P2:column5:S1	0	0	0
P2:column5:S2	0	0	0
P2:column5:S3	0	0	0
P2:column5:S4	0	0	0
R1:S1	-2	0	0
R1:S2	1	0	0
R1:S3	5	0	0
R1:S4	0	0	0

R2:S1	-1	0	0
R2:S2	-1	0	0
R2:S3	4	0	0
R2:S4	0	0	0
R3:S1	-4	0	0
R3:S2	0	0	0
R3:S3	4	0	0
R3:S4	0	0	0
R4:S1	-8	0	0
R4:S2	-5	0	0
R4:S3	-2	0	0
R4:S4	0	0	0
R5:S1	0	0	0
R5:S2	0	0	0
R5:S3	0	0	0
R5:S4	0	0	0
column1:R1:S1	3	0	0
column1:R1:S2	1	0	0
column1:R1:S3	-7	0	0
column1:R1:S4	0	0	0
column1:R2:S1	-4	0	0
column1:R2:S2	2	0	0
column1:R2:S3	-6	0	0
column1:R2:S4	0	0	0
column1:R3:S1	3	0	0
column1:R3:S2	1	0	0
column1:R3:S3	-7	0	0
column1:R3:S4	0	0	0
column1:R4:S1	0	0	0
column1:R4:S2	3	0	0
column1:R4:S3	1	0	0
column1:R4:S4	0	0	0
column1:R5:S1	0	0	0
column1:R5:S2	0	0	0
column1:R5:S3	0	0	0
column1:R5:S4	0	0	0
column2:R1:S1	12	0	0
column2:R1:S2	16	0	0
column2:R1:S3	-1	0	0
column2:R1:S4	0	0	0
column2:R2:S1	4	0	0
column2:R2:S2	11	0	0
column2:R2:S3	-4	0	0
column2:R2:S4	0	0	0
column2:R3:S1	6	0	0
column2:R3:S2	10	0	0
column2:R3:S3	-10	0	0
column2:R3:S4	0	0	0

column2:R4:S1	11	0	0
column2:R4:S2	13	0	0
column2:R4:S3	-1	0	0
column2:R4:S4	0	0	0
column2:R5:S1	0	0	0
column2:R5:S2	0	0	0
column2:R5:S3	0	0	0
column2:R5:S4	0	0	0
column3:R1:S1	5	0	0
column3:R1:S2	1	0	0
column3:R1:S3	-7	0	0
column3:R1:S4	0	0	0
column3:R2:S1	1	0	0
column3:R2:S2	0	0	0
column3:R2:S3	-7	0	0
column3:R2:S4	0	0	0
column3:R3:S1	8	0	0
column3:R3:S2	1	0	0
column3:R3:S3	0	0	0
column3:R3:S4	0	0	0
column3:R4:S1	17	0	0
column3:R4:S2	12	0	0
column3:R4:S3	8	0	0
column3:R4:S4	0	0	0
column3:R5:S1	0	0	0
column3:R5:S2	0	0	0
column3:R5:S3	0	0	0
column3:R5:S4	0	0	0
column4:R1:S1	-3	0	0
column4:R1:S2	-5	0	0
column4:R1:S3	-8	0	0
column4:R1:S4	0	0	0
column4:R2:S1	-9	0	0
column4:R2:S2	-5	0	0
column4:R2:S3	-4	0	0
column4:R2:S4	0	0	0
column4:R3:S1	4	0	0
column4:R3:S2	1	0	0
column4:R3:S3	-2	0	0
column4:R3:S4	0	0	0
column4:R4:S1	6	0	0
column4:R4:S2	2	0	0
column4:R4:S3	-1	0	0
column4:R4:S4	0	0	0
column4:R5:S1	0	0	0
column4:R5:S2	0	0	0
column4:R5:S3	0	0	0
column4:R5:S4	0	0	0

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

P2:R3:S1	0	0	0
P2:R3:S2	0	0	0
P2:R3:S3	0	0	0
P2:R3:S4	0	0	0
P2:R4:S1	0	0	0
P2:R4:S2	0	0	0
P2:R4:S3	0	0	0
P2:R4:S4	0	0	0
P2:R5:S1	0	0	0
P2:R5:S2	0	0	0
P2:R5:S3	0	0	0
P2:R5:S4	0	0	0
P1:column1:R1:S1	-3	0	0
P1:column1:R1:S2	-11	0	0
P1:column1:R1:S3	13	0	0
P1:column1:R1:S4	0	0	0
P1:column1:R2:S1	4	0	0
P1:column1:R2:S2	-6	0	0
P1:column1:R2:S3	10	0	0
P1:column1:R2:S4	0	0	0
P1:column1:R3:S1	-2	0	0
P1:column1:R3:S2	-6	0	0
P1:column1:R3:S3	6	0	0
P1:column1:R3:S4	0	0	0
P1:column1:R4:S1	-1	0	0
P1:column1:R4:S2	-4	0	0
P1:column1:R4:S3	-1	0	0
P1:column1:R4:S4	0	0	0
P1:column1:R5:S1	0	0	0
P1:column1:R5:S2	0	0	0
P1:column1:R5:S3	0	0	0
P1:column1:R5:S4	0	0	0
P1:column2:R1:S1	-8	0	0
P1:column2:R1:S2	-28	0	0
P1:column2:R1:S3	1	0	0
P1:column2:R1:S4	0	0	0
P1:column2:R2:S1	5	0	0
P1:column2:R2:S2	-13	0	0
P1:column2:R2:S3	9	0	0
P1:column2:R2:S4	0	0	0
P1:column2:R3:S1	5	0	0
P1:column2:R3:S2	-4	0	0
P1:column2:R3:S3	16	0	0
P1:column2:R3:S4	0	0	0
P1:column2:R4:S1	-3	0	0
P1:column2:R4:S2	-12	0	0
P1:column2:R4:S3	1	0	0
P1:column2:R4:S4	0	0	0

P1:column2:R5:S1	0	0	0
P1:column2:R5:S2	0	0	0
P1:column2:R5:S3	0	0	0
P1:column2:R5:S4	0	0	0
P1:column3:R1:S1	-7	0	0
P1:column3:R1:S2	-18	0	0
P1:column3:R1:S3	7	0	0
P1:column3:R1:S4	0	0	0
P1:column3:R2:S1	0	0	0
P1:column3:R2:S2	-2	0	0
P1:column3:R2:S3	14	0	0
P1:column3:R2:S4	0	0	0
P1:column3:R3:S1	-9	0	0
P1:column3:R3:S2	-6	0	0
P1:column3:R3:S3	0	0	0
P1:column3:R3:S4	0	0	0
P1:column3:R4:S1	-19	0	0
P1:column3:R4:S2	-15	0	0
P1:column3:R4:S3	-8	0	0
P1:column3:R4:S4	0	0	0
P1:column3:R5:S1	0	0	0
P1:column3:R5:S2	0	0	0
P1:column3:R5:S3	0	0	0
P1:column3:R5:S4	0	0	0
P1:column4:R1:S1	2	0	0
P1:column4:R1:S2	-6	0	0
P1:column4:R1:S3	10	0	0
P1:column4:R1:S4	0	0	0
P1:column4:R2:S1	15	0	0
P1:column4:R2:S2	3	0	0
P1:column4:R2:S3	10	0	0
P1:column4:R2:S4	0	0	0
P1:column4:R3:S1	-5	0	0
P1:column4:R3:S2	-1	0	0
P1:column4:R3:S3	3	0	0
P1:column4:R3:S4	0	0	0
P1:column4:R4:S1	-3	0	0
P1:column4:R4:S2	2	0	0
P1:column4:R4:S3	9	0	0
P1:column4:R4:S4	0	0	0
P1:column4:R5:S1	0	0	0
P1:column4:R5:S2	0	0	0
P1:column4:R5:S3	0	0	0
P1:column4:R5:S4	0	0	0
P1:column5:R1:S1	0	0	0
P1:column5:R1:S2	0	0	0
P1:column5:R1:S3	0	0	0
P1:column5:R1:S4	0	0	0

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

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

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

(79) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)          8         0             0
row1                 0         0             0
row2                 0         0             0
row3                 0         0             0
row4                -3         0             0
row5                 0         0             0
R1                  -8         0             0
R2                   1         0             0
R3                  -5         0             0
R4                  -6         0             0
R5                   0         0             0
P1                   0         0             0
P2                   0         0             0
S1                   0         0             0
S2                  -1         0             0
S3                   1         0             0
S4                   0         0             0
```

R1:S1	9	0	0
R1:S2	10	0	0
R1:S3	4	0	0
R1:S4	0	0	0
R2:S1	0	0	0
R2:S2	-2	0	0
R2:S3	-2	0	0
R2:S4	0	0	0
R3:S1	3	0	0
R3:S2	6	0	0
R3:S3	3	0	0
R3:S4	0	0	0
R4:S1	7	0	0
R4:S2	8	0	0
R4:S3	5	0	0
R4:S4	0	0	0
R5:S1	0	0	0
R5:S2	0	0	0
R5:S3	0	0	0
R5:S4	0	0	0
row1:P1	-1	0	0
row1:P2	0	0	0
row2:P1	-2	0	0
row2:P2	0	0	0
row3:P1	0	0	0
row3:P2	0	0	0
row4:P1	1	0	0
row4:P2	0	0	0
row5:P1	0	0	0
row5:P2	0	0	0
R1:P1	9	0	0
R1:P2	0	0	0
R2:P1	0	0	0
R2:P2	0	0	0
R3:P1	6	0	0
R3:P2	0	0	0
R4:P1	6	0	0
R4:P2	0	0	0
R5:P1	0	0	0
R5:P2	0	0	0
row1:R1:P1	1	0	0
row1:R1:P2	9	0	0
row1:R2:P1	2	0	0
row1:R2:P2	-2	0	0
row1:R3:P1	5	0	0
row1:R3:P2	8	0	0
row1:R4:P1	2	0	0
row1:R4:P2	5	0	0

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

P2:S3	0	0	0
P2:S4	0	0	0
row1:P1:S1	3	0	0
row1:P1:S2	3	0	0
row1:P1:S3	1	0	0
row1:P1:S4	0	0	0
row1:P2:S1	-2	0	0
row1:P2:S2	1	0	0
row1:P2:S3	-1	0	0
row1:P2:S4	0	0	0
row2:P1:S1	3	0	0
row2:P1:S2	-3	0	0
row2:P1:S3	1	0	0
row2:P1:S4	0	0	0
row2:P2:S1	1	0	0
row2:P2:S2	-1	0	0
row2:P2:S3	-6	0	0
row2:P2:S4	0	0	0
row3:P1:S1	-5	0	0
row3:P1:S2	0	0	0
row3:P1:S3	0	0	0
row3:P1:S4	0	0	0
row3:P2:S1	-1	0	0
row3:P2:S2	-7	0	0
row3:P2:S3	0	0	0
row3:P2:S4	0	0	0
row4:P1:S1	0	0	0
row4:P1:S2	-1	0	0
row4:P1:S3	-2	0	0
row4:P1:S4	0	0	0
row4:P2:S1	3	0	0
row4:P2:S2	5	0	0
row4:P2:S3	1	0	0
row4:P2:S4	0	0	0
row5:P1:S1	0	0	0
row5:P1:S2	0	0	0
row5:P1:S3	0	0	0
row5:P1:S4	0	0	0
row5:P2:S1	0	0	0
row5:P2:S2	0	0	0
row5:P2:S3	0	0	0
row5:P2:S4	0	0	0
R1:P1:S1	-9	0	0
R1:P1:S2	-11	0	0
R1:P1:S3	-7	0	0
R1:P1:S4	0	0	0
R1:P2:S1	0	0	0
R1:P2:S2	0	0	0

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

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

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

row3:R4:P2:S3	-6	0	0
row3:R4:P2:S4	0	0	0
row3:R5:P1:S1	0	0	0
row3:R5:P1:S2	0	0	0
row3:R5:P1:S3	0	0	0
row3:R5:P1:S4	0	0	0
row3:R5:P2:S1	0	0	0
row3:R5:P2:S2	0	0	0
row3:R5:P2:S3	0	0	0
row3:R5:P2:S4	0	0	0
row4:R1:P1:S1	1	0	0
row4:R1:P1:S2	3	0	0
row4:R1:P1:S3	8	0	0
row4:R1:P1:S4	0	0	0
row4:R1:P2:S1	-11	0	0
row4:R1:P2:S2	-13	0	0
row4:R1:P2:S3	-7	0	0
row4:R1:P2:S4	0	0	0
row4:R2:P1:S1	1	0	0
row4:R2:P1:S2	2	0	0
row4:R2:P1:S3	6	0	0
row4:R2:P1:S4	0	0	0
row4:R2:P2:S1	-1	0	0
row4:R2:P2:S2	0	0	0
row4:R2:P2:S3	1	0	0
row4:R2:P2:S4	0	0	0
row4:R3:P1:S1	3	0	0
row4:R3:P1:S2	0	0	0
row4:R3:P1:S3	4	0	0
row4:R3:P1:S4	0	0	0
row4:R3:P2:S1	-4	0	0
row4:R3:P2:S2	-9	0	0
row4:R3:P2:S3	-1	0	0
row4:R3:P2:S4	0	0	0
row4:R4:P1:S1	2	0	0
row4:R4:P1:S2	-2	0	0
row4:R4:P1:S3	2	0	0
row4:R4:P1:S4	0	0	0
row4:R4:P2:S1	-17	0	0
row4:R4:P2:S2	-19	0	0
row4:R4:P2:S3	-14	0	0
row4:R4:P2:S4	0	0	0
row4:R5:P1:S1	0	0	0
row4:R5:P1:S2	0	0	0
row4:R5:P1:S3	0	0	0
row4:R5:P1:S4	0	0	0
row4:R5:P2:S1	0	0	0
row4:R5:P2:S2	0	0	0

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

7.7 Example 5.1

(80) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   8.0833         0    0.86156 15  9.3822 1.149e-07 ***
R1           -0.5417         0    0.67056 15 -0.8078 0.4318411
R2           -0.1250         0    0.62082 15 -0.2013 0.8431323
R3            0.0000         0    0.00000 15
A1           -0.4167         0    0.67056 15 -0.6214 0.5436847
A2            0.0000         0    0.00000 15
R1:A1         0.4375         0    0.98160 15  0.4457 0.6621795
R1:A2         0.0000         0    0.00000 15
R2:A1        -3.7292         0    0.91382 15 -4.0808 0.0009837 ***
R2:A2         0.0000         0    0.00000 15
R3:A1         0.0000         0    0.00000 15
R3:A2         0.0000         0    0.00000 15
C1            0.5000         0    0.58531 15  0.8542 0.4064073
C2            0.3333         0    0.58531 15  0.5695 0.5774500
C3            0.0000         0    0.00000 15
B1            0.1250         0    1.03470 15  0.1208 0.9054464
B2            0.0000         0    0.00000 15
C1:B1        -0.5000         0    0.82776 15 -0.6040 0.5548431
C1:B2         0.0000         0    0.00000 15
C2:B1        -0.1667         0    0.82776 15 -0.2013 0.8431323
C2:B2         0.0000         0    0.00000 15
C3:B1         0.0000         0    0.00000 15
C3:B2         0.0000         0    0.00000 15
Tx1          -5.4792         0    0.89008 15 -6.1558 1.839e-05 ***
Tx2          -2.7083         0    0.85323 15 -3.1742 0.0062873 **
Tx3          -1.2292         0    0.89008 15 -1.3810 0.1875206
Tx4          -0.9167         0    0.89008 15 -1.0299 0.3193930
Tx5          -2.2917         0    0.89008 15 -2.5747 0.0211374 *
Tx6           0.0000         0    0.00000 15
B1:Tx1        1.6250         0    1.34112 15  1.2117 0.2443809
B1:Tx2       -0.2500         0    1.24164 15 -0.2013 0.8431323
B1:Tx3        1.1250         0    1.34112 15  0.8388 0.4147227
B1:Tx4        1.5000         0    1.34112 15  1.1185 0.2809609
B1:Tx5       -0.7500         0    1.34112 15 -0.5592 0.5842567
B1:Tx6        0.0000         0    0.00000 15
B2:Tx1        0.0000         0    0.00000 15
B2:Tx2        0.0000         0    0.00000 15
B2:Tx3        0.0000         0    0.00000 15
B2:Tx4        0.0000         0    0.00000 15
B2:Tx5        0.0000         0    0.00000 15
B2:Tx6        0.0000         0    0.00000 15
```

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

(81) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   7.7083         0    0.84451 15  9.1276 1.638e-07 ***
R1           -0.3333         0    0.57373 15 -0.5810  0.569873
R2           -0.1667         0    0.57373 15 -0.2905  0.775414
R3            0.0000         0    0.00000 15
A1            0.2292         0    1.01422 15  0.2260  0.824288
A2            0.0000         0    0.00000 15
R1:A1        -0.3333         0    0.81138 15 -0.4108  0.687010
R1:A2         0.0000         0    0.00000 15
R2:A1        -4.1667         0    0.81138 15 -5.1353  0.000122 ***
R2:A2         0.0000         0    0.00000 15
R3:A1         0.0000         0    0.00000 15
R3:A2         0.0000         0    0.00000 15
C1            0.0625         0    0.65729 15  0.0951  0.925504
C2            0.4375         0    0.60853 15  0.7189  0.483227
C3            0.0000         0    0.00000 15
B1            0.5938         0    0.65729 15  0.9033  0.380630
B2            0.0000         0    0.00000 15
C1:B1        -0.0625         0    0.89574 15 -0.0698  0.945294
C1:B2         0.0000         0    0.00000 15
C2:B1        -0.1563         0    0.89574 15 -0.1744  0.863854
C2:B2         0.0000         0    0.00000 15
C3:B1         0.0000         0    0.00000 15
C3:B2         0.0000         0    0.00000 15
Tx1          -4.8854         0    0.87247 15 -5.5995 5.070e-05 ***
Tx2          -2.5208         0    0.83635 15 -3.0141  0.008719 **
Tx3          -0.8854         0    0.87247 15 -1.0148  0.326271
Tx4           0.7083         0    0.87247 15  0.8119  0.429560
Tx5          -3.2292         0    0.87247 15 -3.7012  0.002134 **
Tx6           0.0000         0    0.00000 15
A1:Tx1        0.4375         0    1.31458 15  0.3328  0.743887
A1:Tx2       -0.6250         0    1.21707 15 -0.5135  0.615061
A1:Tx3        0.4375         0    1.31458 15  0.3328  0.743887
A1:Tx4       -1.7500         0    1.31458 15 -1.3312  0.202996
A1:Tx5        1.1250         0    1.31458 15  0.8558  0.405580
A1:Tx6        0.0000         0    0.00000 15
A2:Tx1        0.0000         0    0.00000 15
A2:Tx2        0.0000         0    0.00000 15
A2:Tx3        0.0000         0    0.00000 15
A2:Tx4        0.0000         0    0.00000 15
A2:Tx5        0.0000         0    0.00000 15
```

```
A2:Tx6        0.0000         0    0.00000 15
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(82) 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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   7.9545         0    0.98427 11  8.0817  5.93e-06 ***
R1           -0.6318         0    0.73222 11 -0.8629 0.4066247
R2           -0.1636         0    0.66557 11 -0.2459 0.8103184
R3            0.0000         0    0.00000 11
A1            0.2273         0    1.10928 11  0.2049 0.8414057
A2            0.0000         0    0.00000 11
R1:A1         0.4636         0    1.09010 11  0.4253 0.6788082
R1:A2         0.0000         0    0.00000 11
R2:A1        -3.7682         0    0.98951 11 -3.8081 0.0029022 **
R2:A2         0.0000         0    0.00000 11
R3:A1         0.0000         0    0.00000 11
R3:A2         0.0000         0    0.00000 11
C1            0.2682         0    0.73222 11  0.3663 0.7211200
C2            0.4364         0    0.66557 11  0.6556 0.5255407
C3            0.0000         0    0.00000 11
B1           -0.2409         0    1.17470 11 -0.2051 0.8412545
B2            0.0000         0    0.00000 11
C1:B1        -0.2318         0    0.98951 11 -0.2343 0.8190745
C1:B2         0.0000         0    0.00000 11
C2:B1         0.0318         0    0.98951 11  0.0322 0.9749241
C2:B2         0.0000         0    0.00000 11
C3:B1         0.0000         0    0.00000 11
C3:B2         0.0000         0    0.00000 11
Tx1          -5.3485         0    1.04397 11 -5.1232 0.0003318 ***
Tx2          -2.5152         0    1.00973 11 -2.4909 0.0299872 *
Tx3          -1.1667         0    1.04397 11 -1.1175 0.2875828
Tx4           0.2424         0    1.22954 11  0.1972 0.8472929
Tx5          -2.6167         0    1.17171 11 -2.2332 0.0472599 *
Tx6           0.0000         0    0.00000 11
A1:Tx1       -0.4182         0    1.59983 11 -0.2614 0.7986202
A1:Tx2       -0.6182         0    1.42305 11 -0.4344 0.6723913
A1:Tx3       -0.2000         0    1.59983 11 -0.1250 0.9027684
A1:Tx4       -2.0091         0    1.51170 11 -1.3290 0.2107461
A1:Tx5       -0.1000         0    1.98612 11 -0.0503 0.9607465
A1:Tx6        0.0000         0    0.00000 11
```

```
A2:Tx1        0.0000         0    0.00000 11
A2:Tx2        0.0000         0    0.00000 11
A2:Tx3        0.0000         0    0.00000 11
A2:Tx4        0.0000         0    0.00000 11
A2:Tx5        0.0000         0    0.00000 11
A2:Tx6        0.0000         0    0.00000 11
B1:Tx1        1.7818         0    1.59983 11  1.1138 0.2891291
B1:Tx2       -0.0182         0    1.42305 11 -0.0128 0.9900347
B1:Tx3        1.2000         0    1.59983 11  0.7501 0.4689466
B1:Tx4        1.1909         0    1.51170 11  0.7878 0.4474596
B1:Tx5        0.0000         0    0.00000 11
B1:Tx6        0.0000         0    0.00000 11
B2:Tx1        0.0000         0    0.00000 11
B2:Tx2        0.0000         0    0.00000 11
B2:Tx3        0.0000         0    0.00000 11
B2:Tx4        0.0000         0    0.00000 11
B2:Tx5        0.0000         0    0.00000 11
B2:Tx6        0.0000         0    0.00000 11
---
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) R   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
```

(83) 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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   8.5833         0    0.86189  7  9.9587 2.199e-05 ***
R1           -1.2833         0    0.79282  7 -1.6187 0.1495477
R2           -0.0500         0    0.55549  7 -0.0900 0.9308004
R3            0.0000         0    0.00000  7
A1           -0.5833         0    0.98561  7 -0.5918 0.5725621
A2            0.0000         0    0.00000  7
R1:A1         1.7250         0    1.00570  7  1.7152 0.1300172
R1:A2         0.0000         0    0.00000  7
R2:A1        -3.4083         0    1.01136  7 -3.3700 0.0119197 *
R2:A2         0.0000         0    0.00000  7
R3:A1         0.0000         0    0.00000  7
R3:A2         0.0000         0    0.00000  7
C1           -0.3833         0    0.79282  7 -0.4835 0.6434958
C2            0.5500         0    0.55549  7  0.9901 0.3551012
C3            0.0000         0    0.00000  7
B1           -0.4417         0    0.94112  7 -0.4693 0.6531236
B2            0.0000         0    0.00000  7
C1:B1         0.2833         0    0.96806  7  0.2927 0.7782513
C1:B2         0.0000         0    0.00000  7
C2:B1        -0.6917         0    0.82462  7 -0.8388 0.4293080
C2:B2         0.0000         0    0.00000  7
C3:B1         0.0000         0    0.00000  7
C3:B2         0.0000         0    0.00000  7
Tx1          -5.8333         0    0.95618  7 -6.1006 0.0004908 ***
Tx2          -2.2500         0    0.92582  7 -2.4303 0.0454020 *
Tx3          -1.8333         0    0.95618  7 -1.9173 0.0967067 .
Tx4           2.0833         0    1.37321  7  1.5171 0.1730222
Tx5          -2.6167         0    0.90079  7 -2.9048 0.0228276 *
```

Tx6	0.0000	0	0.00000	7			
A1:Tx1	-0.2250	0	1.75173	7	-0.1284	0.9014099	
A1:Tx2	-1.3000	0	1.69706	7	-0.7660	0.4686960	
A1:Tx3	0.6750	0	1.75173	7	0.3853	0.7114327	
A1:Tx4	-4.8500	0	1.70713	7	-2.8410	0.0250077	*
A1:Tx5	-0.1000	0	1.52690	7	-0.0655	0.9496134	
A1:Tx6	0.0000	0	0.00000	7			
A2:Tx1	0.0000	0	0.00000	7			
A2:Tx2	0.0000	0	0.00000	7			
A2:Tx3	0.0000	0	0.00000	7			
A2:Tx4	0.0000	0	0.00000	7			
A2:Tx5	0.0000	0	0.00000	7			
A2:Tx6	0.0000	0	0.00000	7			
B1:Tx1	1.9750	0	1.75173	7	1.1275	0.2967084	
B1:Tx2	-0.7000	0	1.69706	7	-0.4125	0.6923283	
B1:Tx3	2.0750	0	1.75173	7	1.1845	0.2748540	
B1:Tx4	-1.6500	0	1.70713	7	-0.9665	0.3659742	
B1:Tx5	0.0000	0	0.00000	7			
B1:Tx6	0.0000	0	0.00000	7			
B2:Tx1	0.0000	0	0.00000	7			
B2:Tx2	0.0000	0	0.00000	7			
B2:Tx3	0.0000	0	0.00000	7			
B2:Tx4	0.0000	0	0.00000	7			
B2:Tx5	0.0000	0	0.00000	7			
B2:Tx6	0.0000	0	0.00000	7			
A1:B1:Tx1	0.8750	0	2.32379	7	0.3765	0.7176693	
A1:B1:Tx2	1.2500	0	2.37847	7	0.5255	0.6154343	
A1:B1:Tx3	-0.6250	0	2.32379	7	-0.2690	0.7957174	
A1:B1:Tx4	6.0000	0	2.02837	7	2.9580	0.0211639	*
A1:B1:Tx5		0					
A1:B1:Tx6	0.0000	0	0.00000	7			
A1:B2:Tx1	0.0000	0	0.00000	7			
A1:B2:Tx2	0.0000	0	0.00000	7			
A1:B2:Tx3	0.0000	0	0.00000	7			
A1:B2:Tx4	0.0000	0	0.00000	7			
A1:B2:Tx5	0.0000	0	0.00000	7			
A1:B2:Tx6	0.0000	0	0.00000	7			
A2:B1:Tx1	0.0000	0	0.00000	7			
A2:B1:Tx2	0.0000	0	0.00000	7			
A2:B1:Tx3	0.0000	0	0.00000	7			
A2:B1:Tx4	0.0000	0	0.00000	7			
A2:B1:Tx5	0.0000	0	0.00000	7			
A2:B1:Tx6	0.0000	0	0.00000	7			
A2:B2:Tx1	0.0000	0	0.00000	7			
A2:B2:Tx2	0.0000	0	0.00000	7			
A2:B2:Tx3	0.0000	0	0.00000	7			
A2:B2:Tx4	0.0000	0	0.00000	7			
A2:B2:Tx5		0					

```
A2:B2:Tx6     0.0000         0    0.00000  7
---
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

(84) 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 Estimable Std. Error Df t value  Pr(>|t|)
```

```
(Intercept)   8.0000         0    0.75691 24 10.5693 1.649e-10 ***
R1            0.3333         0    0.87401 24  0.3814 0.7062732
R2            0.0000         0    0.87401 24  0.0000 1.0000000
R3           -0.3333         0    0.87401 24 -0.3814 0.7062732
R4            0.0000         0    0.00000 24
G1           -1.3333         0    1.31101 24 -1.0170 0.3192843
G2           -3.3333         0    1.31101 24 -2.5426 0.0178716 *
G3           -2.3333         0    1.31101 24 -1.7798 0.0877763 .
G4           -4.3333         0    1.31101 24 -3.3053 0.0029729 **
G5           -0.3333         0    1.31101 24 -0.2543 0.8014631
G6           -1.3333         0    1.31101 24 -1.0170 0.3192843
G7           -5.0000         0    1.31101 24 -3.8139 0.0008422 ***
G8           -3.0000         0    1.31101 24 -2.2883 0.0312238 *
G9           -4.0000         0    1.31101 24 -3.0511 0.0054948 **
G10          -3.0000         0    1.31101 24 -2.2883 0.0312238 *
G11           0.0000         0    1.31101 24  0.0000 1.0000000
G12          -1.0000         0    1.31101 24 -0.7628 0.4530330
G13           1.3333         0    1.31101 24  1.0170 0.3192843
G14           0.3333         0    1.31101 24  0.2543 0.8014631
G15          -1.6667         0    1.31101 24 -1.2713 0.2158111
G16           1.3333         0    1.31101 24  1.0170 0.3192843
G17           0.3333         0    1.31101 24  0.2543 0.8014631
G18           0.3333         0    1.31101 24  0.2543 0.8014631
G19           1.0000         0    1.31101 24  0.7628 0.4530330
G20           0.0000         0    1.31101 24  0.0000 1.0000000
G21           0.0000         0    1.31101 24  0.0000 1.0000000
G22           1.0000         0    1.31101 24  0.7628 0.4530330
G23           1.0000         0    1.31101 24  0.7628 0.4530330
G24           1.0000         0    1.31101 24  0.7628 0.4530330
G25          -1.0833         0    1.07044 24 -1.0120 0.3216098
G26          -2.3333         0    1.07044 24 -2.1798 0.0393133 *
G27           1.0833         0    1.07044 24  1.0120 0.3216098
G28           0.0000         0    0.00000 24
R1:G1         0.0000         0    0.00000 24
R1:G2         0.0000         0    0.00000 24
R1:G3         0.0000         0    0.00000 24
R1:G4         0.0000         0    0.00000 24
R1:G5         0.0000         0    0.00000 24
R1:G6         0.0000         0    0.00000 24
R1:G7                        0
R1:G8                        0
R1:G9                        0
R1:G10                       0
R1:G11                       0
R1:G12                       0
R1:G13                       0
R1:G14                       0
R1:G15                       0
```

R1:G16		0				
R1:G17		0				
R1:G18		0				
R1:G19		0				
R1:G20		0				
R1:G21		0				
R1:G22		0				
R1:G23		0				
R1:G24		0				
R1:G25	-1.3333	0	1.23603	24	-1.0787	0.2914354
R1:G26	-1.3333	0	1.23603	24	-1.0787	0.2914354
R1:G27	-0.6667	0	1.23603	24	-0.5394	0.5946075
R1:G28	0.0000	0	0.00000	24		
R2:G1		0				
R2:G2		0				
R2:G3		0				
R2:G4		0				
R2:G5		0				
R2:G6		0				
R2:G7	0.0000	0	0.00000	24		
R2:G8	0.0000	0	0.00000	24		
R2:G9	0.0000	0	0.00000	24		
R2:G10	0.0000	0	0.00000	24		
R2:G11	0.0000	0	0.00000	24		
R2:G12	0.0000	0	0.00000	24		
R2:G13		0				
R2:G14		0				
R2:G15		0				
R2:G16		0				
R2:G17		0				
R2:G18		0				
R2:G19		0				
R2:G20		0				
R2:G21		0				
R2:G22		0				
R2:G23		0				
R2:G24		0				
R2:G25	-0.6667	0	1.23603	24	-0.5394	0.5946075
R2:G26	-1.3333	0	1.23603	24	-1.0787	0.2914354
R2:G27	-1.0000	0	1.23603	24	-0.8090	0.4264404
R2:G28	0.0000	0	0.00000	24		
R3:G1		0				
R3:G2		0				
R3:G3		0				
R3:G4		0				
R3:G5		0				
R3:G6		0				
R3:G7		0				

R3:G8		0				
R3:G9		0				
R3:G10		0				
R3:G11		0				
R3:G12		0				
R3:G13	0.0000	0	0.00000	24		
R3:G14	0.0000	0	0.00000	24		
R3:G15	0.0000	0	0.00000	24		
R3:G16	0.0000	0	0.00000	24		
R3:G17	0.0000	0	0.00000	24		
R3:G18	0.0000	0	0.00000	24		
R3:G19		0				
R3:G20		0				
R3:G21		0				
R3:G22		0				
R3:G23		0				
R3:G24		0				
R3:G25	1.3333	0	1.23603	24	1.0787	0.2914354
R3:G26	1.0000	0	1.23603	24	0.8090	0.4264404
R3:G27	-0.6667	0	1.23603	24	-0.5394	0.5946075
R3:G28	0.0000	0	0.00000	24		
R4:G1		0				
R4:G2		0				
R4:G3		0				
R4:G4		0				
R4:G5		0				
R4:G6		0				
R4:G7		0				
R4:G8		0				
R4:G9		0				
R4:G10		0				
R4:G11		0				
R4:G12		0				
R4:G13		0				
R4:G14		0				
R4:G15		0				
R4:G16		0				
R4:G17		0				
R4:G18		0				
R4:G19	0.0000	0	0.00000	24		
R4:G20	0.0000	0	0.00000	24		
R4:G21	0.0000	0	0.00000	24		
R4:G22	0.0000	0	0.00000	24		
R4:G23	0.0000	0	0.00000	24		
R4:G24	0.0000	0	0.00000	24		
R4:G25	0.0000	0	0.00000	24		
R4:G26	0.0000	0	0.00000	24		
R4:G27	0.0000	0	0.00000	24		

R4:G28	0.0000	0	0.00000	24			
F1	0.0000	0	0.75691	24	0.0000	1.0000000	
F2	0.0000	0	0.75691	24	0.0000	1.0000000	
F3	0.0000	0	0.00000	24			
G1:F1	-5.0000	0	1.69251	24	-2.9542	0.0069174	**
G1:F2	-2.0000	0	1.69251	24	-1.1817	0.2489103	
G1:F3	0.0000	0	0.00000	24			
G2:F1	-2.0000	0	1.69251	24	-1.1817	0.2489103	
G2:F2	1.0000	0	1.69251	24	0.5908	0.5601518	
G2:F3	0.0000	0	0.00000	24			
G3:F1	-2.0000	0	1.69251	24	-1.1817	0.2489103	
G3:F2	1.0000	0	1.69251	24	0.5908	0.5601518	
G3:F3	0.0000	0	0.00000	24			
G4:F1	1.0000	0	1.69251	24	0.5908	0.5601518	
G4:F2	4.0000	0	1.69251	24	2.3634	0.0265504	*
G4:F3	0.0000	0	0.00000	24			
G5:F1	-2.0000	0	1.69251	24	-1.1817	0.2489103	
G5:F2	0.0000	0	1.69251	24	0.0000	1.0000000	
G5:F3	0.0000	0	0.00000	24			
G6:F1	0.0000	0	1.69251	24	0.0000	1.0000000	
G6:F2	1.0000	0	1.69251	24	0.5908	0.5601518	
G6:F3	0.0000	0	0.00000	24			
G7:F1	-2.0000	0	1.69251	24	-1.1817	0.2489103	
G7:F2	-1.0000	0	1.69251	24	-0.5908	0.5601518	
G7:F3	0.0000	0	0.00000	24			
G8:F1	-3.0000	0	1.69251	24	-1.7725	0.0890040	.
G8:F2	-2.0000	0	1.69251	24	-1.1817	0.2489103	
G8:F3	0.0000	0	0.00000	24			
G9:F1	-1.0000	0	1.69251	24	-0.5908	0.5601518	
G9:F2	0.0000	0	1.69251	24	0.0000	1.0000000	
G9:F3	0.0000	0	0.00000	24			
G10:F1	-1.0000	0	1.69251	24	-0.5908	0.5601518	
G10:F2	-1.0000	0	1.69251	24	-0.5908	0.5601518	
G10:F3	0.0000	0	0.00000	24			
G11:F1	0.0000	0	1.69251	24	0.0000	1.0000000	
G11:F2	0.0000	0	1.69251	24	0.0000	1.0000000	
G11:F3	0.0000	0	0.00000	24			
G12:F1	-4.0000	0	1.69251	24	-2.3634	0.0265504	*
G12:F2	-2.0000	0	1.69251	24	-1.1817	0.2489103	
G12:F3	0.0000	0	0.00000	24			
G13:F1	-2.0000	0	1.69251	24	-1.1817	0.2489103	
G13:F2	-2.0000	0	1.69251	24	-1.1817	0.2489103	
G13:F3	0.0000	0	0.00000	24			
G14:F1	-3.0000	0	1.69251	24	-1.7725	0.0890040	.
G14:F2	-2.0000	0	1.69251	24	-1.1817	0.2489103	
G14:F3	0.0000	0	0.00000	24			
G15:F1	-3.0000	0	1.69251	24	-1.7725	0.0890040	.
G15:F2	-1.0000	0	1.69251	24	-0.5908	0.5601518	

```
G15:F3        0.0000         0    0.00000 24
G16:F1       -2.0000         0    1.69251 24 -1.1817 0.2489103
G16:F2       -2.0000         0    1.69251 24 -1.1817 0.2489103
G16:F3        0.0000         0    0.00000 24
G17:F1       -2.0000         0    1.69251 24 -1.1817 0.2489103
G17:F2        0.0000         0    1.69251 24  0.0000 1.0000000
G17:F3        0.0000         0    0.00000 24
G18:F1       -3.0000         0    1.69251 24 -1.7725 0.0890040 .
G18:F2       -1.0000         0    1.69251 24 -0.5908 0.5601518
G18:F3        0.0000         0    0.00000 24
G19:F1       -4.0000         0    1.69251 24 -2.3634 0.0265504 *
G19:F2       -1.0000         0    1.69251 24 -0.5908 0.5601518
G19:F3        0.0000         0    0.00000 24
G20:F1       -2.0000         0    1.69251 24 -1.1817 0.2489103
G20:F2       -2.0000         0    1.69251 24 -1.1817 0.2489103
G20:F3        0.0000         0    0.00000 24
G21:F1       -1.0000         0    1.69251 24 -0.5908 0.5601518
G21:F2       -4.0000         0    1.69251 24 -2.3634 0.0265504 *
G21:F3        0.0000         0    0.00000 24
G22:F1       -1.0000         0    1.69251 24 -0.5908 0.5601518
G22:F2       -2.0000         0    1.69251 24 -1.1817 0.2489103
G22:F3        0.0000         0    0.00000 24
G23:F1        0.0000         0    1.69251 24  0.0000 1.0000000
G23:F2       -1.0000         0    1.69251 24 -0.5908 0.5601518
G23:F3        0.0000         0    0.00000 24
G24:F1        0.0000         0    1.69251 24  0.0000 1.0000000
G24:F2       -1.0000         0    1.69251 24 -0.5908 0.5601518
G24:F3        0.0000         0    0.00000 24
G25:F1       -3.5000         0    1.07044 24 -3.2697 0.0032428 **
G25:F2       -2.2500         0    1.07044 24 -2.1019 0.0462352 *
G25:F3        0.0000         0    0.00000 24
G26:F1       -2.7500         0    1.07044 24 -2.5690 0.0168399 *
G26:F2       -2.2500         0    1.07044 24 -2.1019 0.0462352 *
G26:F3        0.0000         0    0.00000 24
G27:F1        0.0000         0    1.07044 24  0.0000 1.0000000
G27:F2       -0.2500         0    1.07044 24 -0.2335 0.8173152
G27:F3        0.0000         0    0.00000 24
G28:F1        0.0000         0    0.00000 24
G28:F2        0.0000         0    0.00000 24
G28:F3        0.0000         0    0.00000 24
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
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

(85) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   7.0833         0    0.72409 24  9.7824 7.541e-10 ***
R1           -0.6667         0    0.83611 24 -0.7973  0.433068
R2           -0.3333         0    0.83611 24 -0.3987  0.693659
R3           -1.3333         0    0.83611 24 -1.5947  0.123867
R4            0.0000         0    0.00000 24
T1            0.3333         0    1.02402 24  0.3255  0.747612
T2            1.5833         0    1.02402 24  1.5462  0.135143
T3            0.0833         0    1.02402 24  0.0814  0.935816
T4            0.0000         0    0.00000 24
R1:T1        -0.6667         0    1.18243 24 -0.5638  0.578115
R1:T2         0.3333         0    1.18243 24  0.2819  0.780433
R1:T3         1.6667         0    1.18243 24  1.4095  0.171508
R1:T4         0.0000         0    0.00000 24
R2:T1         0.3333         0    1.18243 24  0.2819  0.780433
R2:T2         0.0000         0    1.18243 24  0.0000  1.000000
R2:T3        -0.6667         0    1.18243 24 -0.5638  0.578115
R2:T4         0.0000         0    0.00000 24
R3:T1         1.0000         0    1.18243 24  0.8457  0.406066
R3:T2         0.3333         0    1.18243 24  0.2819  0.780433
R3:T3         0.6667         0    1.18243 24  0.5638  0.578115
R3:T4         0.0000         0    0.00000 24
R4:T1         0.0000         0    0.00000 24
R4:T2         0.0000         0    0.00000 24
R4:T3         0.0000         0    0.00000 24
R4:T4         0.0000         0    0.00000 24
G1           -3.4167         0    1.25416 24 -2.7243  0.011829 *
G2           -2.4167         0    1.25416 24 -1.9269  0.065909 .
G3           -1.4167         0    1.25416 24 -1.1296  0.269819
G4           -4.4167         0    1.25416 24 -3.5216  0.001746 **
G5           -2.4167         0    1.25416 24 -1.9269  0.065909 .
G6           -1.7500         0    1.25416 24 -1.3954  0.175687
G7           -2.7500         0    1.25416 24 -2.1927  0.038261 *
G8           -1.7500         0    1.25416 24 -1.3954  0.175687
G9            0.2500         0    1.25416 24  0.1993  0.843679
G10           0.2500         0    1.25416 24  0.1993  0.843679
```

G11	0.2500	0	1.25416	24	0.1993	0.843679	
G12	0.2500	0	1.25416	24	0.1993	0.843679	
G13	-1.7500	0	1.25416	24	-1.3954	0.175687	
G14	-3.7500	0	1.25416	24	-2.9900	0.006354	**
G15	1.2500	0	1.25416	24	0.9967	0.328862	
G16	-1.0833	0	1.25416	24	-0.8638	0.396253	
G17	-1.0833	0	1.25416	24	-0.8638	0.396253	
G18	-0.0833	0	1.25416	24	-0.0664	0.947574	
G19	0.9167	0	1.25416	24	0.7309	0.471916	
G20	-1.0000	0	0.72409	24	-1.3810	0.179990	
G21	-2.2500	0	0.72409	24	-3.1074	0.004802	**
G22	0.0000	0	0.00000	24			
T1:G1	5.3333	0	1.77365	24	3.0070	0.006104	**
T1:G2	3.3333	0	1.77365	24	1.8794	0.072391	.
T1:G3	1.3333	0	1.77365	24	0.7517	0.459513	
T1:G4	3.3333	0	1.77365	24	1.8794	0.072391	.
T1:G5	5.3333	0	1.77365	24	3.0070	0.006104	**
T1:G6	-2.6667	0	1.77365	24	-1.5035	0.145759	
T1:G7	-1.6667	0	1.77365	24	-0.9397	0.356743	
T1:G8	-1.6667	0	1.77365	24	-0.9397	0.356743	
T1:G9	-3.6667	0	1.77365	24	-2.0673	0.049653	*
T1:G10	1.3333	0	1.77365	24	0.7517	0.459513	
T1:G11	1.6667	0	1.77365	24	0.9397	0.356743	
T1:G12	1.6667	0	1.77365	24	0.9397	0.356743	
T1:G13	-4.3333	0	1.77365	24	-2.4432	0.022292	*
T1:G14	-1.3333	0	1.77365	24	-0.7517	0.459513	
T1:G15	0.6667	0	1.77365	24	0.3759	0.710313	
T1:G16	2.6667	0	1.77365	24	1.5035	0.145759	
T1:G17	2.6667	0	1.77365	24	1.5035	0.145759	
T1:G18	1.6667	0	1.77365	24	0.9397	0.356743	
T1:G19	0.6667	0	1.77365	24	0.3759	0.710313	
T1:G20	1.0000	0	1.02402	24	0.9765	0.338535	
T1:G21	1.0000	0	1.02402	24	0.9765	0.338535	
T1:G22	0.0000	0	0.00000	24			
T2:G1	4.0833	0	1.77365	24	2.3022	0.030304	*
T2:G2	2.0833	0	1.77365	24	1.1746	0.251677	
T2:G3	-1.9167	0	1.77365	24	-1.0806	0.290600	
T2:G4	1.0833	0	1.77365	24	0.6108	0.547078	
T2:G5	2.0833	0	1.77365	24	1.1746	0.251677	
T2:G6	-3.5833	0	1.77365	24	-2.0203	0.054646	.
T2:G7	-3.5833	0	1.77365	24	-2.0203	0.054646	.
T2:G8	-4.5833	0	1.77365	24	-2.5841	0.016278	*
T2:G9	-3.5833	0	1.77365	24	-2.0203	0.054646	.
T2:G10	-1.5833	0	1.77365	24	-0.8927	0.380883	
T2:G11	1.0833	0	1.77365	24	0.6108	0.547078	
T2:G12	-0.9167	0	1.77365	24	-0.5168	0.610008	
T2:G13	-3.9167	0	1.77365	24	-2.2083	0.037026	*
T2:G14	-2.9167	0	1.77365	24	-1.6444	0.113121	

T2:G15	0.0833	0	1.77365	24	0.0470	0.962915	
T2:G16	0.4167	0	1.77365	24	0.2349	0.816263	
T2:G17	1.4167	0	1.77365	24	0.7987	0.432281	
T2:G18	-1.5833	0	1.77365	24	-0.8927	0.380883	
T2:G19	-3.5833	0	1.77365	24	-2.0203	0.054646	.
T2:G20	1.2500	0	1.02402	24	1.2207	0.234064	
T2:G21	-1.0000	0	1.02402	24	-0.9765	0.338535	
T2:G22	0.0000	0	0.00000	24			
T3:G1	0.2500	0	1.77365	24	0.1410	0.889084	
T3:G2	0.2500	0	1.77365	24	0.1410	0.889084	
T3:G3	0.2500	0	1.77365	24	0.1410	0.889084	
T3:G4	0.2500	0	1.77365	24	0.1410	0.889084	
T3:G5	0.2500	0	1.77365	24	0.1410	0.889084	
T3:G6	-1.4167	0	1.77365	24	-0.7987	0.432281	
T3:G7	-0.4167	0	1.77365	24	-0.2349	0.816263	
T3:G8	-1.4167	0	1.77365	24	-0.7987	0.432281	
T3:G9	-0.4167	0	1.77365	24	-0.2349	0.816263	
T3:G10	0.5833	0	1.77365	24	0.3289	0.745093	
T3:G11	0.2500	0	1.77365	24	0.1410	0.889084	
T3:G12	0.2500	0	1.77365	24	0.1410	0.889084	
T3:G13	-1.7500	0	1.77365	24	-0.9867	0.333650	
T3:G14	-0.7500	0	1.77365	24	-0.4229	0.676165	
T3:G15	0.2500	0	1.77365	24	0.1410	0.889084	
T3:G16	0.9167	0	1.77365	24	0.5168	0.610008	
T3:G17	0.9167	0	1.77365	24	0.5168	0.610008	
T3:G18	1.9167	0	1.77365	24	1.0806	0.290600	
T3:G19	0.9167	0	1.77365	24	0.5168	0.610008	
T3:G20	0.5000	0	1.02402	24	0.4883	0.629788	
T3:G21	0.2500	0	1.02402	24	0.2441	0.809200	
T3:G22	0.0000	0	0.00000	24			
T4:G1	0.0000	0	0.00000	24			
T4:G2	0.0000	0	0.00000	24			
T4:G3	0.0000	0	0.00000	24			
T4:G4	0.0000	0	0.00000	24			
T4:G5	0.0000	0	0.00000	24			
T4:G6	0.0000	0	0.00000	24			
T4:G7	0.0000	0	0.00000	24			
T4:G8	0.0000	0	0.00000	24			
T4:G9	0.0000	0	0.00000	24			
T4:G10	0.0000	0	0.00000	24			
T4:G11	0.0000	0	0.00000	24			
T4:G12	0.0000	0	0.00000	24			
T4:G13	0.0000	0	0.00000	24			
T4:G14	0.0000	0	0.00000	24			
T4:G15	0.0000	0	0.00000	24			
T4:G16	0.0000	0	0.00000	24			
T4:G17	0.0000	0	0.00000	24			
T4:G18	0.0000	0	0.00000	24			

```
T4:G19        0.0000         0    0.00000 24
T4:G20        0.0000         0    0.00000 24
T4:G21        0.0000         0    0.00000 24
T4:G22        0.0000         0    0.00000 24
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.10 Example 7.3

(86) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   9.0000         0    0.39675 36 22.6845 < 2.2e-16 ***
R1           -1.0000         0    0.45812 36 -2.1828 0.0356525 *
R2           -1.0000         0    0.45812 36 -2.1828 0.0356525 *
R3            0.0000         0    0.45812 36  0.0000 1.0000000
R4            0.0000         0    0.00000 36
T1           -0.2500         0    0.56108 36 -0.4456 0.6585786
T2            0.0000         0    0.00000 36
R1:T1         0.3333         0    0.64788 36  0.5145 0.6100498
R1:T2         0.0000         0    0.00000 36
R2:T1         0.6667         0    0.64788 36  1.0290 0.3103479
R2:T2         0.0000         0    0.00000 36
R3:T1         0.0000         0    0.64788 36  0.0000 1.0000000
R3:T2         0.0000         0    0.00000 36
R4:T1         0.0000         0    0.00000 36
R4:T2         0.0000         0    0.00000 36
G1           -3.0000         0    0.68718 36 -4.3656 0.0001024 ***
G2            0.0000         0    0.68718 36  0.0000 1.0000000
G3            1.0000         0    0.68718 36  1.4552 0.1542753
G4            1.0000         0    0.68718 36  1.4552 0.1542753
G5            1.0000         0    0.68718 36  1.4552 0.1542753
G6           -1.0000         0    0.68718 36 -1.4552 0.1542753
G7           -1.0000         0    0.68718 36 -1.4552 0.1542753
G8            0.0000         0    0.68718 36  0.0000 1.0000000
G9            1.0000         0    0.68718 36  1.4552 0.1542753
G10          -1.0000         0    0.68718 36 -1.4552 0.1542753
G11          -3.0000         0    0.68718 36 -4.3656 0.0001024 ***
```

G12	0.0000	0	0.68718	36	0.0000	1.0000000	
G13	0.0000	0	0.68718	36	0.0000	1.0000000	
G14	-1.0000	0	0.68718	36	-1.4552	0.1542753	
G15	-2.0000	0	0.68718	36	-2.9104	0.0061560	**
G16	-5.0000	0	0.68718	36	-7.2761	1.431e-08	***
G17	-3.0000	0	0.68718	36	-4.3656	0.0001024	***
G18	-2.0000	0	0.68718	36	-2.9104	0.0061560	**
G19	-2.0000	0	0.68718	36	-2.9104	0.0061560	**
G20	-1.0000	0	0.68718	36	-1.4552	0.1542753	
G21	-2.0000	0	0.56108	36	-3.5645	0.0010508	**
G22	-0.3333	0	0.56108	36	-0.5941	0.5561681	
G23	0.0000	0	0.00000	36			
T1:G1	0.9167	0	0.97183	36	0.9432	0.3518445	
T1:G2	-1.0833	0	0.97183	36	-1.1147	0.2723483	
T1:G3	-0.0833	0	0.97183	36	-0.0857	0.9321409	
T1:G4	-0.0833	0	0.97183	36	-0.0857	0.9321409	
T1:G5	-0.0833	0	0.97183	36	-0.0857	0.9321409	
T1:G6	-1.4167	0	0.97183	36	-1.4577	0.1535818	
T1:G7	0.5833	0	0.97183	36	0.6002	0.5521031	
T1:G8	0.5833	0	0.97183	36	0.6002	0.5521031	
T1:G9	-0.4167	0	0.97183	36	-0.4287	0.6706625	
T1:G10	-1.4167	0	0.97183	36	-1.4577	0.1535818	
T1:G11	0.2500	0	0.97183	36	0.2572	0.7984521	
T1:G12	-0.7500	0	0.97183	36	-0.7717	0.4453029	
T1:G13	-1.7500	0	0.97183	36	-1.8007	0.0801274	.
T1:G14	1.2500	0	0.97183	36	1.2862	0.2065706	
T1:G15	-2.7500	0	0.97183	36	-2.8297	0.0075715	**
T1:G16	1.2500	0	0.97183	36	1.2862	0.2065706	
T1:G17	-0.7500	0	0.97183	36	-0.7717	0.4453029	
T1:G18	-0.7500	0	0.97183	36	-0.7717	0.4453029	
T1:G19	0.2500	0	0.97183	36	0.2572	0.7984521	
T1:G20	-0.7500	0	0.97183	36	-0.7717	0.4453029	
T1:G21	1.1667	0	0.79349	36	1.4703	0.1501689	
T1:G22	-1.0000	0	0.79349	36	-1.2603	0.2156865	
T1:G23	0.0000	0	0.00000	36			
T2:G1	0.0000	0	0.00000	36			
T2:G2	0.0000	0	0.00000	36			
T2:G3	0.0000	0	0.00000	36			
T2:G4	0.0000	0	0.00000	36			
T2:G5	0.0000	0	0.00000	36			
T2:G6	0.0000	0	0.00000	36			
T2:G7	0.0000	0	0.00000	36			
T2:G8	0.0000	0	0.00000	36			
T2:G9	0.0000	0	0.00000	36			
T2:G10	0.0000	0	0.00000	36			
T2:G11	0.0000	0	0.00000	36			
T2:G12	0.0000	0	0.00000	36			
T2:G13	0.0000	0	0.00000	36			

T2:G14	0.0000	0	0.00000	36		
T2:G15	0.0000	0	0.00000	36		
T2:G16	0.0000	0	0.00000	36		
T2:G17	0.0000	0	0.00000	36		
T2:G18	0.0000	0	0.00000	36		
T2:G19	0.0000	0	0.00000	36		
T2:G20	0.0000	0	0.00000	36		
T2:G21	0.0000	0	0.00000	36		
T2:G22	0.0000	0	0.00000	36		
T2:G23	0.0000	0	0.00000	36		
R1:T1:G1	0.0000	0	0.00000	36		
R1:T1:G2	0.0000	0	0.00000	36		
R1:T1:G3	0.0000	0	0.00000	36		
R1:T1:G4	0.0000	0	0.00000	36		
R1:T1:G5	0.0000	0	0.00000	36		
R1:T1:G6		0				
R1:T1:G7		0				
R1:T1:G8		0				
R1:T1:G9		0				
R1:T1:G10		0				
R1:T1:G11		0				
R1:T1:G12		0				
R1:T1:G13		0				
R1:T1:G14		0				
R1:T1:G15		0				
R1:T1:G16		0				
R1:T1:G17		0				
R1:T1:G18		0				
R1:T1:G19		0				
R1:T1:G20		0				
R1:T1:G21	-1.0000	0	0.64788	36	-1.5435	0.1314585
R1:T1:G22	0.0000	0	0.64788	36	0.0000	1.0000000
R1:T1:G23	0.0000	0	0.00000	36		
R1:T2:G1	0.0000	0	0.00000	36		
R1:T2:G2	0.0000	0	0.00000	36		
R1:T2:G3	0.0000	0	0.00000	36		
R1:T2:G4	0.0000	0	0.00000	36		
R1:T2:G5	0.0000	0	0.00000	36		
R1:T2:G6		0				
R1:T2:G7		0				
R1:T2:G8		0				
R1:T2:G9		0				
R1:T2:G10		0				
R1:T2:G11		0				
R1:T2:G12		0				
R1:T2:G13		0				
R1:T2:G14		0				
R1:T2:G15		0				

R1:T2:G16		0				
R1:T2:G17		0				
R1:T2:G18		0				
R1:T2:G19		0				
R1:T2:G20		0				
R1:T2:G21	0.6667	0	0.64788	36	1.0290	0.3103479
R1:T2:G22	0.0000	0	0.64788	36	0.0000	1.0000000
R1:T2:G23	0.0000	0	0.00000	36		
R2:T1:G1		0				
R2:T1:G2		0				
R2:T1:G3		0				
R2:T1:G4		0				
R2:T1:G5		0				
R2:T1:G6	0.0000	0	0.00000	36		
R2:T1:G7	0.0000	0	0.00000	36		
R2:T1:G8	0.0000	0	0.00000	36		
R2:T1:G9	0.0000	0	0.00000	36		
R2:T1:G10	0.0000	0	0.00000	36		
R2:T1:G11		0				
R2:T1:G12		0				
R2:T1:G13		0				
R2:T1:G14		0				
R2:T1:G15		0				
R2:T1:G16		0				
R2:T1:G17		0				
R2:T1:G18		0				
R2:T1:G19		0				
R2:T1:G20		0				
R2:T1:G21	-1.0000	0	0.64788	36	-1.5435	0.1314585
R2:T1:G22	-0.3333	0	0.64788	36	-0.5145	0.6100498
R2:T1:G23	0.0000	0	0.00000	36		
R2:T2:G1		0				
R2:T2:G2		0				
R2:T2:G3		0				
R2:T2:G4		0				
R2:T2:G5		0				
R2:T2:G6	0.0000	0	0.00000	36		
R2:T2:G7	0.0000	0	0.00000	36		
R2:T2:G8	0.0000	0	0.00000	36		
R2:T2:G9	0.0000	0	0.00000	36		
R2:T2:G10	0.0000	0	0.00000	36		
R2:T2:G11		0				
R2:T2:G12		0				
R2:T2:G13		0				
R2:T2:G14		0				
R2:T2:G15		0				
R2:T2:G16		0				
R2:T2:G17		0				

R2:T2:G18		0				
R2:T2:G19		0				
R2:T2:G20		0				
R2:T2:G21	-1.0000	0	0.64788	36	-1.5435	0.1314585
R2:T2:G22	0.3333	0	0.64788	36	0.5145	0.6100498
R2:T2:G23	0.0000	0	0.00000	36		
R3:T1:G1		0				
R3:T1:G2		0				
R3:T1:G3		0				
R3:T1:G4		0				
R3:T1:G5		0				
R3:T1:G6		0				
R3:T1:G7		0				
R3:T1:G8		0				
R3:T1:G9		0				
R3:T1:G10		0				
R3:T1:G11	0.0000	0	0.00000	36		
R3:T1:G12	0.0000	0	0.00000	36		
R3:T1:G13	0.0000	0	0.00000	36		
R3:T1:G14	0.0000	0	0.00000	36		
R3:T1:G15	0.0000	0	0.00000	36		
R3:T1:G16		0				
R3:T1:G17		0				
R3:T1:G18		0				
R3:T1:G19		0				
R3:T1:G20		0				
R3:T1:G21	-1.6667	0	0.64788	36	-2.5725	0.0143678 *
R3:T1:G22	0.6667	0	0.64788	36	1.0290	0.3103479
R3:T1:G23	0.0000	0	0.00000	36		
R3:T2:G1		0				
R3:T2:G2		0				
R3:T2:G3		0				
R3:T2:G4		0				
R3:T2:G5		0				
R3:T2:G6		0				
R3:T2:G7		0				
R3:T2:G8		0				
R3:T2:G9		0				
R3:T2:G10		0				
R3:T2:G11	0.0000	0	0.00000	36		
R3:T2:G12	0.0000	0	0.00000	36		
R3:T2:G13	0.0000	0	0.00000	36		
R3:T2:G14	0.0000	0	0.00000	36		
R3:T2:G15	0.0000	0	0.00000	36		
R3:T2:G16		0				
R3:T2:G17		0				
R3:T2:G18		0				
R3:T2:G19		0				

R3:T2:G20		0				
R3:T2:G21	-0.6667	0	0.64788	36	-1.0290	0.3103479
R3:T2:G22	0.0000	0	0.64788	36	0.0000	1.0000000
R3:T2:G23	0.0000	0	0.00000	36		
R4:T1:G1		0				
R4:T1:G2		0				
R4:T1:G3		0				
R4:T1:G4		0				
R4:T1:G5		0				
R4:T1:G6		0				
R4:T1:G7		0				
R4:T1:G8		0				
R4:T1:G9		0				
R4:T1:G10		0				
R4:T1:G11		0				
R4:T1:G12		0				
R4:T1:G13		0				
R4:T1:G14		0				
R4:T1:G15		0				
R4:T1:G16	0.0000	0	0.00000	36		
R4:T1:G17	0.0000	0	0.00000	36		
R4:T1:G18	0.0000	0	0.00000	36		
R4:T1:G19	0.0000	0	0.00000	36		
R4:T1:G20	0.0000	0	0.00000	36		
R4:T1:G21	0.0000	0	0.00000	36		
R4:T1:G22	0.0000	0	0.00000	36		
R4:T1:G23	0.0000	0	0.00000	36		
R4:T2:G1		0				
R4:T2:G2		0				
R4:T2:G3		0				
R4:T2:G4		0				
R4:T2:G5		0				
R4:T2:G6		0				
R4:T2:G7		0				
R4:T2:G8		0				
R4:T2:G9		0				
R4:T2:G10		0				
R4:T2:G11		0				
R4:T2:G12		0				
R4:T2:G13		0				
R4:T2:G14		0				
R4:T2:G15		0				
R4:T2:G16	0.0000	0	0.00000	36		
R4:T2:G17	0.0000	0	0.00000	36		
R4:T2:G18	0.0000	0	0.00000	36		
R4:T2:G19	0.0000	0	0.00000	36		
R4:T2:G20	0.0000	0	0.00000	36		
R4:T2:G21	0.0000	0	0.00000	36		

```
R4:T2:G22     0.0000         0    0.00000 36
R4:T2:G23     0.0000         0    0.00000 36
F1           -2.0000         0    0.39675 36 -5.0410 1.325e-05 ***
F2           -1.0000         0    0.39675 36 -2.5205 0.0162919 *
F3            0.0000         0    0.00000 36
T1:F1        -0.2500         0    0.56108 36 -0.4456 0.6585786
T1:F2         0.0000         0    0.56108 36  0.0000 1.0000000
T1:F3         0.0000         0    0.00000 36
T2:F1         0.0000         0    0.00000 36
T2:F2         0.0000         0    0.00000 36
T2:F3         0.0000         0    0.00000 36
G1:F1         0.0000         0    0.88715 36  0.0000 1.0000000
G1:F2         0.0000         0    0.88715 36  0.0000 1.0000000
G1:F3         0.0000         0    0.00000 36
G2:F1        -2.0000         0    0.88715 36 -2.2544 0.0303508 *
G2:F2        -1.0000         0    0.88715 36 -1.1272 0.2671137
G2:F3         0.0000         0    0.00000 36
G3:F1         0.0000         0    0.88715 36  0.0000 1.0000000
G3:F2         0.0000         0    0.88715 36  0.0000 1.0000000
G3:F3         0.0000         0    0.00000 36
G4:F1         2.0000         0    0.88715 36  2.2544 0.0303508 *
G4:F2         0.0000         0    0.88715 36  0.0000 1.0000000
G4:F3         0.0000         0    0.00000 36
G5:F1         0.0000         0    0.88715 36  0.0000 1.0000000
G5:F2         1.0000         0    0.88715 36  1.1272 0.2671137
G5:F3         0.0000         0    0.00000 36
G6:F1         0.0000         0    0.88715 36  0.0000 1.0000000
G6:F2         0.0000         0    0.88715 36  0.0000 1.0000000
G6:F3         0.0000         0    0.00000 36
G7:F1         1.0000         0    0.88715 36  1.1272 0.2671137
G7:F2         1.0000         0    0.88715 36  1.1272 0.2671137
G7:F3         0.0000         0    0.00000 36
G8:F1         1.0000         0    0.88715 36  1.1272 0.2671137
G8:F2         2.0000         0    0.88715 36  2.2544 0.0303508 *
G8:F3         0.0000         0    0.00000 36
G9:F1         0.0000         0    0.88715 36  0.0000 1.0000000
G9:F2        -1.0000         0    0.88715 36 -1.1272 0.2671137
G9:F3         0.0000         0    0.00000 36
G10:F1       -1.0000         0    0.88715 36 -1.1272 0.2671137
G10:F2       -1.0000         0    0.88715 36 -1.1272 0.2671137
G10:F3        0.0000         0    0.00000 36
G11:F1        1.0000         0    0.88715 36  1.1272 0.2671137
G11:F2        0.0000         0    0.88715 36  0.0000 1.0000000
G11:F3        0.0000         0    0.00000 36
G12:F1        1.0000         0    0.88715 36  1.1272 0.2671137
G12:F2        0.0000         0    0.88715 36  0.0000 1.0000000
G12:F3        0.0000         0    0.00000 36
G13:F1        0.0000         0    0.88715 36  0.0000 1.0000000
```

G13:F2	-1.0000	0	0.88715	36	-1.1272	0.2671137	
G13:F3	0.0000	0	0.00000	36			
G14:F1	1.0000	0	0.88715	36	1.1272	0.2671137	
G14:F2	1.0000	0	0.88715	36	1.1272	0.2671137	
G14:F3	0.0000	0	0.00000	36			
G15:F1	-1.0000	0	0.88715	36	-1.1272	0.2671137	
G15:F2	-1.0000	0	0.88715	36	-1.1272	0.2671137	
G15:F3	0.0000	0	0.00000	36			
G16:F1	0.0000	0	0.88715	36	0.0000	1.0000000	
G16:F2	-1.0000	0	0.88715	36	-1.1272	0.2671137	
G16:F3	0.0000	0	0.00000	36			
G17:F1	-1.0000	0	0.88715	36	-1.1272	0.2671137	
G17:F2	0.0000	0	0.88715	36	0.0000	1.0000000	
G17:F3	0.0000	0	0.00000	36			
G18:F1	-1.0000	0	0.88715	36	-1.1272	0.2671137	
G18:F2	0.0000	0	0.88715	36	0.0000	1.0000000	
G18:F3	0.0000	0	0.00000	36			
G19:F1	0.0000	0	0.88715	36	0.0000	1.0000000	
G19:F2	1.0000	0	0.88715	36	1.1272	0.2671137	
G19:F3	0.0000	0	0.00000	36			
G20:F1	0.0000	0	0.88715	36	0.0000	1.0000000	
G20:F2	0.0000	0	0.88715	36	0.0000	1.0000000	
G20:F3	0.0000	0	0.00000	36			
G21:F1	-1.2500	0	0.56108	36	-2.2278	0.0322306	*
G21:F2	0.2500	0	0.56108	36	0.4456	0.6585786	
G21:F3	0.0000	0	0.00000	36			
G22:F1	0.0000	0	0.56108	36	0.0000	1.0000000	
G22:F2	0.0000	0	0.56108	36	0.0000	1.0000000	
G22:F3	0.0000	0	0.00000	36			
G23:F1	0.0000	0	0.00000	36			
G23:F2	0.0000	0	0.00000	36			
G23:F3	0.0000	0	0.00000	36			
T1:G1:F1	-1.7500	0	1.25462	36	-1.3948	0.1716105	
T1:G1:F2	-1.0000	0	1.25462	36	-0.7971	0.4306457	
T1:G1:F3	0.0000	0	0.00000	36			
T1:G2:F1	0.2500	0	1.25462	36	0.1993	0.8431780	
T1:G2:F2	0.0000	0	1.25462	36	0.0000	1.0000000	
T1:G2:F3	0.0000	0	0.00000	36			
T1:G3:F1	0.2500	0	1.25462	36	0.1993	0.8431780	
T1:G3:F2	-1.0000	0	1.25462	36	-0.7971	0.4306457	
T1:G3:F3	0.0000	0	0.00000	36			
T1:G4:F1	-0.7500	0	1.25462	36	-0.5978	0.5537222	
T1:G4:F2	0.0000	0	1.25462	36	0.0000	1.0000000	
T1:G4:F3	0.0000	0	0.00000	36			
T1:G5:F1	1.2500	0	1.25462	36	0.9963	0.3257463	
T1:G5:F2	-1.0000	0	1.25462	36	-0.7971	0.4306457	
T1:G5:F3	0.0000	0	0.00000	36			
T1:G6:F1	0.2500	0	1.25462	36	0.1993	0.8431780	

T1:G6:F2	0.0000	0	1.25462	36	0.0000	1.0000000
T1:G6:F3	0.0000	0	0.00000	36		
T1:G7:F1	-0.7500	0	1.25462	36	-0.5978	0.5537222
T1:G7:F2	-1.0000	0	1.25462	36	-0.7971	0.4306457
T1:G7:F3	0.0000	0	0.00000	36		
T1:G8:F1	-0.7500	0	1.25462	36	-0.5978	0.5537222
T1:G8:F2	-2.0000	0	1.25462	36	-1.5941	0.1196553
T1:G8:F3	0.0000	0	0.00000	36		
T1:G9:F1	0.2500	0	1.25462	36	0.1993	0.8431780
T1:G9:F2	1.0000	0	1.25462	36	0.7971	0.4306457
T1:G9:F3	0.0000	0	0.00000	36		
T1:G10:F1	0.2500	0	1.25462	36	0.1993	0.8431780
T1:G10:F2	1.0000	0	1.25462	36	0.7971	0.4306457
T1:G10:F3	0.0000	0	0.00000	36		
T1:G11:F1	-0.7500	0	1.25462	36	-0.5978	0.5537222
T1:G11:F2	0.0000	0	1.25462	36	0.0000	1.0000000
T1:G11:F3	0.0000	0	0.00000	36		
T1:G12:F1	0.2500	0	1.25462	36	0.1993	0.8431780
T1:G12:F2	1.0000	0	1.25462	36	0.7971	0.4306457
T1:G12:F3	0.0000	0	0.00000	36		
T1:G13:F1	1.2500	0	1.25462	36	0.9963	0.3257463
T1:G13:F2	2.0000	0	1.25462	36	1.5941	0.1196553
T1:G13:F3	0.0000	0	0.00000	36		
T1:G14:F1	-0.7500	0	1.25462	36	-0.5978	0.5537222
T1:G14:F2	-2.0000	0	1.25462	36	-1.5941	0.1196553
T1:G14:F3	0.0000	0	0.00000	36		
T1:G15:F1	1.2500	0	1.25462	36	0.9963	0.3257463
T1:G15:F2	1.0000	0	1.25462	36	0.7971	0.4306457
T1:G15:F3	0.0000	0	0.00000	36		
T1:G16:F1	-1.7500	0	1.25462	36	-1.3948	0.1716105
T1:G16:F2	0.0000	0	1.25462	36	0.0000	1.0000000
T1:G16:F3	0.0000	0	0.00000	36		
T1:G17:F1	0.2500	0	1.25462	36	0.1993	0.8431780
T1:G17:F2	0.0000	0	1.25462	36	0.0000	1.0000000
T1:G17:F3	0.0000	0	0.00000	36		
T1:G18:F1	0.2500	0	1.25462	36	0.1993	0.8431780
T1:G18:F2	-1.0000	0	1.25462	36	-0.7971	0.4306457
T1:G18:F3	0.0000	0	0.00000	36		
T1:G19:F1	-0.7500	0	1.25462	36	-0.5978	0.5537222
T1:G19:F2	-2.0000	0	1.25462	36	-1.5941	0.1196553
T1:G19:F3	0.0000	0	0.00000	36		
T1:G20:F1	0.2500	0	1.25462	36	0.1993	0.8431780
T1:G20:F2	-1.0000	0	1.25462	36	-0.7971	0.4306457
T1:G20:F3	0.0000	0	0.00000	36		
T1:G21:F1	0.2500	0	0.79349	36	0.3151	0.7545328
T1:G21:F2	-0.7500	0	0.79349	36	-0.9452	0.3508634
T1:G21:F3	0.0000	0	0.00000	36		
T1:G22:F1	0.0000	0	0.79349	36	0.0000	1.0000000

T1:G22:F2	0.0000	0	0.79349	36	0.0000	1.0000000
T1:G22:F3	0.0000	0	0.00000	36		
T1:G23:F1	0.0000	0	0.00000	36		
T1:G23:F2	0.0000	0	0.00000	36		
T1:G23:F3	0.0000	0	0.00000	36		
T2:G1:F1	0.0000	0	0.00000	36		
T2:G1:F2	0.0000	0	0.00000	36		
T2:G1:F3	0.0000	0	0.00000	36		
T2:G2:F1	0.0000	0	0.00000	36		
T2:G2:F2	0.0000	0	0.00000	36		
T2:G2:F3	0.0000	0	0.00000	36		
T2:G3:F1	0.0000	0	0.00000	36		
T2:G3:F2	0.0000	0	0.00000	36		
T2:G3:F3	0.0000	0	0.00000	36		
T2:G4:F1	0.0000	0	0.00000	36		
T2:G4:F2	0.0000	0	0.00000	36		
T2:G4:F3	0.0000	0	0.00000	36		
T2:G5:F1	0.0000	0	0.00000	36		
T2:G5:F2	0.0000	0	0.00000	36		
T2:G5:F3	0.0000	0	0.00000	36		
T2:G6:F1	0.0000	0	0.00000	36		
T2:G6:F2	0.0000	0	0.00000	36		
T2:G6:F3	0.0000	0	0.00000	36		
T2:G7:F1	0.0000	0	0.00000	36		
T2:G7:F2	0.0000	0	0.00000	36		
T2:G7:F3	0.0000	0	0.00000	36		
T2:G8:F1	0.0000	0	0.00000	36		
T2:G8:F2	0.0000	0	0.00000	36		
T2:G8:F3	0.0000	0	0.00000	36		
T2:G9:F1	0.0000	0	0.00000	36		
T2:G9:F2	0.0000	0	0.00000	36		
T2:G9:F3	0.0000	0	0.00000	36		
T2:G10:F1	0.0000	0	0.00000	36		
T2:G10:F2	0.0000	0	0.00000	36		
T2:G10:F3	0.0000	0	0.00000	36		
T2:G11:F1	0.0000	0	0.00000	36		
T2:G11:F2	0.0000	0	0.00000	36		
T2:G11:F3	0.0000	0	0.00000	36		
T2:G12:F1	0.0000	0	0.00000	36		
T2:G12:F2	0.0000	0	0.00000	36		
T2:G12:F3	0.0000	0	0.00000	36		
T2:G13:F1	0.0000	0	0.00000	36		
T2:G13:F2	0.0000	0	0.00000	36		
T2:G13:F3	0.0000	0	0.00000	36		
T2:G14:F1	0.0000	0	0.00000	36		
T2:G14:F2	0.0000	0	0.00000	36		
T2:G14:F3	0.0000	0	0.00000	36		
T2:G15:F1	0.0000	0	0.00000	36		

```
T2:G15:F2     0.0000         0    0.00000 36
T2:G15:F3     0.0000         0    0.00000 36
T2:G16:F1     0.0000         0    0.00000 36
T2:G16:F2     0.0000         0    0.00000 36
T2:G16:F3     0.0000         0    0.00000 36
T2:G17:F1     0.0000         0    0.00000 36
T2:G17:F2     0.0000         0    0.00000 36
T2:G17:F3     0.0000         0    0.00000 36
T2:G18:F1     0.0000         0    0.00000 36
T2:G18:F2     0.0000         0    0.00000 36
T2:G18:F3     0.0000         0    0.00000 36
T2:G19:F1     0.0000         0    0.00000 36
T2:G19:F2     0.0000         0    0.00000 36
T2:G19:F3     0.0000         0    0.00000 36
T2:G20:F1     0.0000         0    0.00000 36
T2:G20:F2     0.0000         0    0.00000 36
T2:G20:F3     0.0000         0    0.00000 36
T2:G21:F1     0.0000         0    0.00000 36
T2:G21:F2     0.0000         0    0.00000 36
T2:G21:F3     0.0000         0    0.00000 36
T2:G22:F1     0.0000         0    0.00000 36
T2:G22:F2     0.0000         0    0.00000 36
T2:G22:F3     0.0000         0    0.00000 36
T2:G23:F1     0.0000         0    0.00000 36
T2:G23:F2     0.0000         0    0.00000 36
T2:G23:F3     0.0000         0    0.00000 36
---
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

(87) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)       14         0             0
R1               -10         0             0
R2               -10         0             0
R3                 0         0             0
A1                 1         0             0
A2                 0         0             0
A3                 1         0             0
A4                 4         0             0
A5                 4         0             0
A6                 8         0             0
A7                 0         0             0
A8                31         0             0
A9                20         0             0
A10               -4         0             0
A11                0         0             0
A12                1         0             0
A13                0         0             0
R1:A1              0         0             0
R1:A2              0         0             0
R1:A3              0         0             0
R1:A4                        0
R1:A5                        0
R1:A6                        0
R1:A7                        0
R1:A8                        0
R1:A9                        0
R1:A10             5         0             0
R1:A11             0         0             0
R1:A12             0         0             0
R1:A13             0         0             0
R2:A1                        0
R2:A2                        0
R2:A3                        0
R2:A4              0         0             0
R2:A5              0         0             0
R2:A6              0         0             0
R2:A7                        0
R2:A8                        0
R2:A9                        0
R2:A10             5         0             0
R2:A11             0         0             0
R2:A12             0         0             0
R2:A13             0         0             0
R3:A1                        0
R3:A2                        0
```

R3:A3		0	
R3:A4		0	
R3:A5		0	
R3:A6		0	
R3:A7	0	0	0
R3:A8	0	0	0
R3:A9	0	0	0
R3:A10	0	0	0
R3:A11	0	0	0
R3:A12	0	0	0
R3:A13	0	0	0
B1	5	0	0
B2	3	0	0
B3	5	0	0
B4	3	0	0
B5	-5	0	0
B6	3	0	0
B7	-1	0	0
B8	1	0	0
B9	0	0	0
R1:B1	0	0	0
R1:B2	0	0	0
R1:B3		0	
R1:B4		0	
R1:B5		0	
R1:B6		0	
R1:B7	0	0	0
R1:B8	0	0	0
R1:B9	0	0	0
R2:B1		0	
R2:B2		0	
R2:B3	0	0	0
R2:B4	0	0	0
R2:B5		0	
R2:B6		0	
R2:B7	10	0	0
R2:B8	0	0	0
R2:B9	0	0	0
R3:B1		0	
R3:B2		0	
R3:B3		0	
R3:B4		0	
R3:B5	0	0	0
R3:B6	0	0	0
R3:B7	0	0	0
R3:B8	0	0	0
R3:B9	0	0	0
A1:B1	-1	0	0

A1:B2	-6	0	0
A1:B3		0	
A1:B4		0	
A1:B5		0	
A1:B6		0	
A1:B7	4	0	0
A1:B8	1	0	0
A1:B9	0	0	0
A2:B1	0	0	0
A2:B2	0	0	0
A2:B3		0	
A2:B4		0	
A2:B5		0	
A2:B6		0	
A2:B7	0	0	0
A2:B8	0	0	0
A2:B9	0	0	0
A3:B1	-1	0	0
A3:B2	-6	0	0
A3:B3		0	
A3:B4		0	
A3:B5		0	
A3:B6		0	
A3:B7	4	0	0
A3:B8	1	0	0
A3:B9	0	0	0
A4:B1		0	
A4:B2		0	
A4:B3	-4	0	0
A4:B4	-4	0	0
A4:B5		0	
A4:B6		0	
A4:B7	-4	0	0
A4:B8	-1	0	0
A4:B9	0	0	0
A5:B1		0	
A5:B2		0	
A5:B3	-4	0	0
A5:B4	1	0	0
A5:B5		0	
A5:B6		0	
A5:B7	-9	0	0
A5:B8	-2	0	0
A5:B9	0	0	0
A6:B1		0	
A6:B2		0	
A6:B3	-8	0	0
A6:B4	-8	0	0

A6:B5		0	
A6:B6		0	
A6:B7	-8	0	0
A6:B8	-4	0	0
A6:B9	0	0	0
A7:B1		0	
A7:B2		0	
A7:B3		0	
A7:B4		0	
A7:B5	10	0	0
A7:B6	0	0	0
A7:B7	0	0	0
A7:B8	0	0	0
A7:B9	0	0	0
A8:B1		0	
A8:B2		0	
A8:B3		0	
A8:B4		0	
A8:B5	-21	0	0
A8:B6	-36	0	0
A8:B7	-26	0	0
A8:B8	-29	0	0
A8:B9	0	0	0
A9:B1		0	
A9:B2		0	
A9:B3		0	
A9:B4		0	
A9:B5	-10	0	0
A9:B6	-20	0	0
A9:B7	-20	0	0
A9:B8	-10	0	0
A9:B9	0	0	0
A10:B1	-1	0	0
A10:B2	-7	0	0
A10:B3	-1	0	0
A10:B4	3	0	0
A10:B5	10	0	0
A10:B6	-4	0	0
A10:B7	2	0	0
A10:B8	-1	0	0
A10:B9	0	0	0
A11:B1	0	0	0
A11:B2	0	0	0
A11:B3	0	0	0
A11:B4	0	0	0
A11:B5	0	0	0
A11:B6	0	0	0
A11:B7	0	0	0

A11:B8	0	0	0
A11:B9	0	0	0
A12:B1	-1	0	0
A12:B2	-6	0	0
A12:B3	-1	0	0
A12:B4	4	0	0
A12:B5	-1	0	0
A12:B6	-6	0	0
A12:B7	-6	0	0
A12:B8	1	0	0
A12:B9	0	0	0
A13:B1	0	0	0
A13:B2	0	0	0
A13:B3	0	0	0
A13:B4	0	0	0
A13:B5	0	0	0
A13:B6	0	0	0
A13:B7	0	0	0
A13:B8	0	0	0
A13:B9	0	0	0
R1:A1:B1	0	0	0
R1:A1:B2	0	0	0
R1:A1:B3		0	
R1:A1:B4		0	
R1:A1:B5		0	
R1:A1:B6		0	
R1:A1:B7	0	0	0
R1:A1:B8	0	0	0
R1:A1:B9	0	0	0
R1:A2:B1	0	0	0
R1:A2:B2	0	0	0
R1:A2:B3		0	
R1:A2:B4		0	
R1:A2:B5		0	
R1:A2:B6		0	
R1:A2:B7	0	0	0
R1:A2:B8	0	0	0
R1:A2:B9	0	0	0
R1:A3:B1	0	0	0
R1:A3:B2	0	0	0
R1:A3:B3		0	
R1:A3:B4		0	
R1:A3:B5		0	
R1:A3:B6		0	
R1:A3:B7	0	0	0
R1:A3:B8	0	0	0
R1:A3:B9	0	0	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	
R1:A10:B1	0	0	0
R1:A10:B2	0	0	0
R1:A10:B3		0	
R1:A10:B4		0	
R1:A10:B5		0	
R1:A10:B6		0	
R1:A10:B7	3	0	0
R1:A10:B8	2	0	0
R1:A10:B9	0	0	0
R1:A11:B1	0	0	0
R1:A11:B2	0	0	0
R1:A11:B3		0	
R1:A11:B4		0	
R1:A11:B5		0	
R1:A11:B6		0	
R1:A11:B7	0	0	0
R1:A11:B8	0	0	0
R1:A11:B9	0	0	0
R1:A12:B1	0	0	0
R1:A12:B2	0	0	0
R1:A12:B3		0	
R1:A12:B4		0	
R1:A12:B5		0	
R1:A12:B6		0	
R1:A12:B7	10	0	0
R1:A12:B8	0	0	0
R1:A12:B9	0	0	0
R1:A13:B1	0	0	0
R1:A13:B2	0	0	0
R1:A13:B3		0	
R1:A13:B4		0	
R1:A13:B5		0	
R1:A13:B6		0	
R1:A13:B7	0	0	0
R1:A13:B8	0	0	0
R1:A13:B9	0	0	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: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	0	0
R2:A4:B4	0	0	0
R2:A4:B5		0	
R2:A4:B6		0	
R2:A4:B7	0	0	0
R2:A4:B8	0	0	0
R2:A4:B9	0	0	0
R2:A5:B1		0	
R2:A5:B2		0	
R2:A5:B3	0	0	0
R2:A5:B4	0	0	0
R2:A5:B5		0	
R2:A5:B6		0	
R2:A5:B7	0	0	0
R2:A5:B8	0	0	0
R2:A5:B9	0	0	0
R2:A6:B1		0	
R2:A6:B2		0	
R2:A6:B3	0	0	0
R2:A6:B4	0	0	0
R2:A6:B5		0	
R2:A6:B6		0	
R2:A6:B7	0	0	0
R2:A6:B8	0	0	0
R2:A6:B9	0	0	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	
R2:A10:B1		0	
R2:A10:B2		0	
R2:A10:B3	0	0	0
R2:A10:B4	0	0	0
R2:A10:B5		0	
R2:A10:B6		0	
R2:A10:B7	-7	0	0
R2:A10:B8	2	0	0
R2:A10:B9	0	0	0
R2:A11:B1		0	
R2:A11:B2		0	
R2:A11:B3	0	0	0
R2:A11:B4	0	0	0
R2:A11:B5		0	
R2:A11:B6		0	
R2:A11:B7	0	0	0
R2:A11:B8	0	0	0
R2:A11:B9	0	0	0
R2:A12:B1		0	
R2:A12:B2		0	
R2:A12:B3	0	0	0
R2:A12:B4	0	0	0

R2:A12:B5		0	
R2:A12:B6		0	
R2:A12:B7	0	0	0
R2:A12:B8	0	0	0
R2:A12:B9	0	0	0
R2:A13:B1		0	
R2:A13:B2		0	
R2:A13:B3	0	0	0
R2:A13:B4	0	0	0
R2:A13:B5		0	
R2:A13:B6		0	
R2:A13:B7	0	0	0
R2:A13:B8	0	0	0
R2:A13:B9	0	0	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: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	0	0
R3:A7:B6	0	0	0
R3:A7:B7	0	0	0
R3:A7:B8	0	0	0
R3:A7:B9	0	0	0
R3:A8:B1		0	
R3:A8:B2		0	
R3:A8:B3		0	
R3:A8:B4		0	
R3:A8:B5	0	0	0
R3:A8:B6	0	0	0
R3:A8:B7	0	0	0
R3:A8:B8	0	0	0
R3:A8:B9	0	0	0
R3:A9:B1		0	
R3:A9:B2		0	
R3:A9:B3		0	
R3:A9:B4		0	
R3:A9:B5	0	0	0
R3:A9:B6	0	0	0
R3:A9:B7	0	0	0
R3:A9:B8	0	0	0
R3:A9:B9	0	0	0
R3:A10:B1		0	

```
R3:A10:B2                    0
R3:A10:B3                    0
R3:A10:B4                    0
R3:A10:B5          0         0             0
R3:A10:B6          0         0             0
R3:A10:B7          0         0             0
R3:A10:B8          0         0             0
R3:A10:B9          0         0             0
R3:A11:B1                    0
R3:A11:B2                    0
R3:A11:B3                    0
R3:A11:B4                    0
R3:A11:B5          0         0             0
R3:A11:B6          0         0             0
R3:A11:B7          0         0             0
R3:A11:B8          0         0             0
R3:A11:B9          0         0             0
R3:A12:B1                    0
R3:A12:B2                    0
R3:A12:B3                    0
R3:A12:B4                    0
R3:A12:B5          0         0             0
R3:A12:B6          0         0             0
R3:A12:B7          0         0             0
R3:A12:B8          0         0             0
R3:A12:B9          0         0             0
R3:A13:B1                    0
R3:A13:B2                    0
R3:A13:B3                    0
R3:A13:B4                    0
R3:A13:B5          0         0             0
R3:A13:B6          0         0             0
R3:A13:B7          0         0             0
R3:A13:B8          0         0             0
R3:A13:B9          0         0             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

(88) 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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   70.167         0     4.1476 34 16.9175 < 2.2e-16 ***
R1             4.417         0     3.7862 34  1.1665   0.25152
R2             7.692         0     3.7862 34  2.0315   0.05008 .
R3             3.492         0     3.7862 34  0.9222   0.36292
R4             0.000         0     0.0000 34
A1             3.390         0     4.9728 34  0.6816   0.50009
A2            -7.679         0     4.9728 34 -1.5442   0.13179
A3            -1.235         0     4.9728 34 -0.2484   0.80529
```

```
A4              0.000         0     0.0000 34
R1:A1          -1.717         0     4.7892 34 -0.3584   0.72223
R1:A2          -1.042         0     4.7892 34 -0.2175   0.82912
R1:A3          -1.467         0     4.7892 34 -0.3062   0.76129
R1:A4           0.000         0     0.0000 34
R2:A1          -8.992         0     4.7892 34 -1.8775   0.06905 .
R2:A2          -2.817         0     4.7892 34 -0.5881   0.56033
R2:A3          -4.142         0     4.7892 34 -0.8648   0.39322
R2:A4           0.000         0     0.0000 34
R3:A1          -5.217         0     4.7892 34 -1.0893   0.28370
R3:A2          -3.292         0     4.7892 34 -0.6873   0.49655
R3:A3          -4.317         0     4.7892 34 -0.9013   0.37375
R3:A4           0.000         0     0.0000 34
R4:A1           0.000         0     0.0000 34
R4:A2           0.000         0     0.0000 34
R4:A3           0.000         0     0.0000 34
R4:A4           0.000         0     0.0000 34
B1             -3.517         0     3.2790 34 -1.0725   0.29105
B2            -18.817         0     3.2790 34 -5.7386 1.882e-06 ***
B3             -2.100         0     3.3865 34 -0.6201   0.53932
B4              0.000         0     0.0000 34
A1:B1           5.417         0     4.3992 34  1.2313   0.22666
A1:B2          -2.558         0     4.3992 34 -0.5815   0.56471
A1:B3           0.850         0     4.4799 34  0.1897   0.85064
A1:B4           0.000         0     0.0000 34
A2:B1          11.217         0     4.3992 34  2.5497   0.01546 *
A2:B2           5.567         0     4.3992 34  1.2654   0.21434
A2:B3           5.500         0     4.4799 34  1.2277   0.22799
A2:B4           0.000         0     0.0000 34
A3:B1           0.492         0     4.3992 34  0.1118   0.91167
A3:B2          -1.083         0     4.3992 34 -0.2463   0.80696
A3:B3           3.000         0     4.4799 34  0.6697   0.50760
A3:B4           0.000         0     0.0000 34
A4:B1           0.000         0     0.0000 34
A4:B2           0.000         0     0.0000 34
A4:B3           0.000         0     0.0000 34
A4:B4           0.000         0     0.0000 34
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.13 Example 9.2

(89) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   46.556         0    0.98862 16 47.0915 < 2.2e-16 ***
rep1           0.889         0    1.06381 16  0.8356  0.415699
rep2           0.000         0    0.00000 16
hyb0          -2.444         0    1.53826 16 -1.5891  0.131602
hyb1           2.667         0    1.36083 16  1.9596  0.067702 .
```

hyb2	1.000	0	1.36083	16	0.7348	0.473067	
hyb3	-2.167	0	1.36083	16	-1.5922	0.130908	
hyb4	1.000	0	1.36083	16	0.7348	0.473067	
hyb5	-1.333	0	1.36083	16	-0.9798	0.341771	
hyb6	1.500	0	1.36083	16	1.1023	0.286649	
hyb7	4.500	0	1.36083	16	3.3068	0.004455	**
hyb8	-0.167	0	1.36083	16	-0.1225	0.904048	
hyb9	0.000	0	0.00000	16			
rep1:hyb0	0.000	0	0.00000	16			
rep1:hyb1	-3.333	0	1.36083	16	-2.4495	0.026199	*
rep1:hyb2	-4.000	0	1.36083	16	-2.9394	0.009621	**
rep1:hyb3	0.333	0	1.36083	16	0.2449	0.809610	
rep1:hyb4	0.000	0	1.36083	16	0.0000	1.000000	
rep1:hyb5	2.667	0	1.36083	16	1.9596	0.067702	.
rep1:hyb6	-4.000	0	1.36083	16	-2.9394	0.009621	**
rep1:hyb7	-3.000	0	1.36083	16	-2.2045	0.042471	*
rep1:hyb8	-2.667	0	1.36083	16	-1.9596	0.067702	.
rep1:hyb9	0.000	0	0.00000	16			
rep2:hyb0		0					
rep2:hyb1	0.000	0	0.00000	16			
rep2:hyb2	0.000	0	0.00000	16			
rep2:hyb3	0.000	0	0.00000	16			
rep2:hyb4	0.000	0	0.00000	16			
rep2:hyb5	0.000	0	0.00000	16			
rep2:hyb6	0.000	0	0.00000	16			
rep2:hyb7	0.000	0	0.00000	16			
rep2:hyb8	0.000	0	0.00000	16			
rep2:hyb9	0.000	0	0.00000	16			
gen1	-3.056	0	1.24226	16	-2.4597	0.025671	*
gen2	-0.611	0	1.24226	16	-0.4919	0.629446	
gen3	0.000	0	0.00000	16			
rep1:gen1	2.111	0	0.78567	16	2.6870	0.016197	*
rep1:gen2	0.222	0	0.78567	16	0.2828	0.780924	
rep1:gen3	0.000	0	0.00000	16			
rep2:gen1	0.000	0	0.00000	16			
rep2:gen2	0.000	0	0.00000	16			
rep2:gen3	0.000	0	0.00000	16			
hyb0:gen1	3.944	0	2.07870	16	1.8976	0.075951	.
hyb0:gen2	0.389	0	2.07870	16	0.1871	0.853947	
hyb0:gen3	0.000	0	0.00000	16			
hyb1:gen1	-3.000	0	1.66667	16	-1.8000	0.090743	.
hyb1:gen2	-4.000	0	1.66667	16	-2.4000	0.028919	*
hyb1:gen3	0.000	0	0.00000	16			
hyb2:gen1	2.500	0	1.66667	16	1.5000	0.153088	
hyb2:gen2	-2.500	0	1.66667	16	-1.5000	0.153088	
hyb2:gen3	0.000	0	0.00000	16			
hyb3:gen1	2.000	0	1.66667	16	1.2000	0.247607	
hyb3:gen2	-0.500	0	1.66667	16	-0.3000	0.768040	

```
hyb3:gen3      0.000         0    0.00000 16
hyb4:gen1     -2.000         0    1.66667 16 -1.2000  0.247607
hyb4:gen2     -1.000         0    1.66667 16 -0.6000  0.556909
hyb4:gen3      0.000         0    0.00000 16
hyb5:gen1      1.000         0    1.66667 16  0.6000  0.556909
hyb5:gen2      0.000         0    1.66667 16  0.0000  1.000000
hyb5:gen3      0.000         0    0.00000 16
hyb6:gen1     -1.000         0    1.66667 16 -0.6000  0.556909
hyb6:gen2     -0.500         0    1.66667 16 -0.3000  0.768040
hyb6:gen3      0.000         0    0.00000 16
hyb7:gen1     -0.500         0    1.66667 16 -0.3000  0.768040
hyb7:gen2     -2.000         0    1.66667 16 -1.2000  0.247607
hyb7:gen3      0.000         0    0.00000 16
hyb8:gen1      2.500         0    1.66667 16  1.5000  0.153088
hyb8:gen2     -2.000         0    1.66667 16 -1.2000  0.247607
hyb8:gen3      0.000         0    0.00000 16
hyb9:gen1      0.000         0    0.00000 16
hyb9:gen2      0.000         0    0.00000 16
hyb9:gen3      0.000         0    0.00000 16
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
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

(90) MODEL

```r
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"))
```

```r
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 Estimable Std. Error  Df   t value  Pr(>|t|)
(Intercept)           13608.3         0     39.831 240  341.6522 < 2.2e-16 ***
Site1                  -433.3         0     56.329 240   -7.6928 3.713e-13 ***
Site2                  -108.3         0     56.329 240   -1.9232  0.055637 .
Site3                  -116.7         0     56.329 240   -2.0711  0.039414 *
Site4                     0.0         0      0.000 240
Site1:BlockR1           175.0         0     39.831 240    4.3936 1.674e-05 ***
Site1:BlockR2           300.0         0     39.831 240    7.5318 1.013e-12 ***
Site1:BlockR3             0.0         0      0.000 240
Site2:BlockR1          -225.0         0     39.831 240   -5.6489 4.554e-08 ***
Site2:BlockR2          -375.0         0     39.831 240   -9.4148 < 2.2e-16 ***
Site2:BlockR3             0.0         0      0.000 240
Site3:BlockR1          -100.0         0     39.831 240   -2.5106  0.012711 *
Site3:BlockR2           -75.0         0     39.831 240   -1.8830  0.060916 .
Site3:BlockR3             0.0         0      0.000 240
```

Site4:BlockR1	-250.0	0	39.831	240	-6.2765	1.605e-09	***
Site4:BlockR2	-275.0	0	39.831	240	-6.9042	4.483e-11	***
Site4:BlockR3	0.0	0	0.000	240			
AA1	-5705.0	0	56.329	240	-101.2791	< 2.2e-16	***
AA2	-5020.2	0	56.329	240	-89.1230	< 2.2e-16	***
AA3	-3336.7	0	56.329	240	-59.2363	< 2.2e-16	***
AA4	-1241.7	0	56.329	240	-22.0429	< 2.2e-16	***
AA5	0.0	0	0.000	240			
Site1:AA1	-2.4	0	79.662	240	-0.0303	0.975824	
Site1:AA2	25.0	0	79.662	240	0.3138	0.753926	
Site1:AA3	111.2	0	79.662	240	1.3965	0.163846	
Site1:AA4	-16.7	0	79.662	240	-0.2092	0.834456	
Site1:AA5	0.0	0	0.000	240			
Site2:AA1	91.2	0	79.662	240	1.1444	0.253590	
Site2:AA2	132.4	0	79.662	240	1.6622	0.097771	.
Site2:AA3	30.7	0	79.662	240	0.3850	0.700608	
Site2:AA4	-50.0	0	79.662	240	-0.6277	0.530828	
Site2:AA5	0.0	0	0.000	240			
Site3:AA1	39.2	0	79.662	240	0.4917	0.623408	
Site3:AA2	25.8	0	79.662	240	0.3243	0.746003	
Site3:AA3	-38.3	0	79.662	240	-0.4802	0.631555	
Site3:AA4	-41.7	0	79.662	240	-0.5230	0.601426	
Site3:AA5	0.0	0	0.000	240			
Site4:AA1	0.0	0	0.000	240			
Site4:AA2	0.0	0	0.000	240			
Site4:AA3	0.0	0	0.000	240			
Site4:AA4	0.0	0	0.000	240			
Site4:AA5	0.0	0	0.000	240			
BB1	-1300.0	0	56.329	240	-23.0785	< 2.2e-16	***
BB2	0.0	0	0.000	240			
Site1:BB1	-16.7	0	79.662	240	-0.2092	0.834456	
Site1:BB2	0.0	0	0.000	240			
Site2:BB1	100.0	0	79.662	240	1.2553	0.210589	
Site2:BB2	0.0	0	0.000	240			
Site3:BB1	0.0	0	79.662	240	0.0000	1.000000	
Site3:BB2	0.0	0	0.000	240			
Site4:BB1	0.0	0	0.000	240			
Site4:BB2	0.0	0	0.000	240			
AA1:BB1	1438.0	0	79.662	240	18.0513	< 2.2e-16	***
AA1:BB2	0.0	0	0.000	240			
AA2:BB1	1746.3	0	79.662	240	21.9218	< 2.2e-16	***
AA2:BB2	0.0	0	0.000	240			
AA3:BB1	2470.3	0	79.662	240	31.0102	< 2.2e-16	***
AA3:BB2	0.0	0	0.000	240			
AA4:BB1	-68.1	0	79.662	240	-0.8547	0.393595	
AA4:BB2	0.0	0	0.000	240			
AA5:BB1	0.0	0	0.000	240			
AA5:BB2	0.0	0	0.000	240			

Site1:AA1:BB1	54.5	0	112.659	240	0.4838	0.628997
Site1:AA1:BB2	0.0	0	0.000	240		
Site1:AA2:BB1	-20.4	0	112.659	240	-0.1812	0.856344
Site1:AA2:BB2	0.0	0	0.000	240		
Site1:AA3:BB1	-141.2	0	112.659	240	-1.2530	0.211409
Site1:AA3:BB2	0.0	0	0.000	240		
Site1:AA4:BB1	45.6	0	112.659	240	0.4046	0.686122
Site1:AA4:BB2	0.0	0	0.000	240		
Site1:AA5:BB1	0.0	0	0.000	240		
Site1:AA5:BB2	0.0	0	0.000	240		
Site2:AA1:BB1	-90.0	0	112.659	240	-0.7989	0.425155
Site2:AA1:BB2	0.0	0	0.000	240		
Site2:AA2:BB1	-140.2	0	112.659	240	-1.2442	0.214651
Site2:AA2:BB2	0.0	0	0.000	240		
Site2:AA3:BB1	-60.0	0	112.659	240	-0.5326	0.594816
Site2:AA3:BB2	0.0	0	0.000	240		
Site2:AA4:BB1	3.5	0	112.659	240	0.0311	0.975242
Site2:AA4:BB2	0.0	0	0.000	240		
Site2:AA5:BB1	0.0	0	0.000	240		
Site2:AA5:BB2	0.0	0	0.000	240		
Site3:AA1:BB1	12.4	0	112.659	240	0.1102	0.912331
Site3:AA1:BB2	0.0	0	0.000	240		
Site3:AA2:BB1	39.4	0	112.659	240	0.3499	0.726739
Site3:AA2:BB2	0.0	0	0.000	240		
Site3:AA3:BB1	49.8	0	112.659	240	0.4423	0.658643
Site3:AA3:BB2	0.0	0	0.000	240		
Site3:AA4:BB1	32.7	0	112.659	240	0.2900	0.772097
Site3:AA4:BB2	0.0	0	0.000	240		
Site3:AA5:BB1	0.0	0	0.000	240		
Site3:AA5:BB2	0.0	0	0.000	240		
Site4:AA1:BB1	0.0	0	0.000	240		
Site4:AA1:BB2	0.0	0	0.000	240		
Site4:AA2:BB1	0.0	0	0.000	240		
Site4:AA2:BB2	0.0	0	0.000	240		
Site4:AA3:BB1	0.0	0	0.000	240		
Site4:AA3:BB2	0.0	0	0.000	240		
Site4:AA4:BB1	0.0	0	0.000	240		
Site4:AA4:BB2	0.0	0	0.000	240		
Site4:AA5:BB1	0.0	0	0.000	240		
Site4:AA5:BB2	0.0	0	0.000	240		
Site1:BlockR1:AA1:BB1	15.5	0	56.329	240	0.2752	0.783425
Site1:BlockR1:AA1:BB2	-3.5	0	56.329	240	-0.0621	0.950507
Site1:BlockR1:AA2:BB1	70.2	0	56.329	240	1.2471	0.213567
Site1:BlockR1:AA2:BB2	50.0	0	56.329	240	0.8876	0.375626
Site1:BlockR1:AA3:BB1	10.0	0	56.329	240	0.1775	0.859244
Site1:BlockR1:AA3:BB2	-62.3	0	56.329	240	-1.1051	0.270221
Site1:BlockR1:AA4:BB1	50.5	0	56.329	240	0.8965	0.370878
Site1:BlockR1:AA4:BB2	0.0	0	56.329	240	0.0000	1.000000

Site1:BlockR1:AA5:BB1	50.0	0	56.329	240	0.8876	0.375626	
Site1:BlockR1:AA5:BB2	0.0	0	0.000	240			
Site1:BlockR2:AA1:BB1	17.2	0	56.329	240	0.3062	0.759692	
Site1:BlockR2:AA1:BB2	53.7	0	56.329	240	0.9542	0.340939	
Site1:BlockR2:AA2:BB1	61.7	0	56.329	240	1.0962	0.274077	
Site1:BlockR2:AA2:BB2	77.7	0	56.329	240	1.3803	0.168787	
Site1:BlockR2:AA3:BB1	29.0	0	56.329	240	0.5148	0.607147	
Site1:BlockR2:AA3:BB2	-112.3	0	56.329	240	-1.9927	0.047423	*
Site1:BlockR2:AA4:BB1	42.0	0	56.329	240	0.7456	0.456631	
Site1:BlockR2:AA4:BB2	75.0	0	56.329	240	1.3315	0.184303	
Site1:BlockR2:AA5:BB1	0.0	0	56.329	240	0.0000	1.000000	
Site1:BlockR2:AA5:BB2	0.0	0	0.000	240			
Site1:BlockR3:AA1:BB1	0.0	0	0.000	240			
Site1:BlockR3:AA1:BB2	0.0	0	0.000	240			
Site1:BlockR3:AA2:BB1	0.0	0	0.000	240			
Site1:BlockR3:AA2:BB2	0.0	0	0.000	240			
Site1:BlockR3:AA3:BB1	0.0	0	0.000	240			
Site1:BlockR3:AA3:BB2	0.0	0	0.000	240			
Site1:BlockR3:AA4:BB1	0.0	0	0.000	240			
Site1:BlockR3:AA4:BB2	0.0	0	0.000	240			
Site1:BlockR3:AA5:BB1	0.0	0	0.000	240			
Site1:BlockR3:AA5:BB2	0.0	0	0.000	240			
Site2:BlockR1:AA1:BB1	35.7	0	56.329	240	0.6347	0.526255	
Site2:BlockR1:AA1:BB2	-32.3	0	56.329	240	-0.5725	0.567503	
Site2:BlockR1:AA2:BB1	68.5	0	56.329	240	1.2161	0.225157	
Site2:BlockR1:AA2:BB2	-37.5	0	56.329	240	-0.6657	0.506225	
Site2:BlockR1:AA3:BB1	-11.0	0	56.329	240	-0.1953	0.845339	
Site2:BlockR1:AA3:BB2	-30.3	0	56.329	240	-0.5370	0.591752	
Site2:BlockR1:AA4:BB1	46.2	0	56.329	240	0.8211	0.412426	
Site2:BlockR1:AA4:BB2	25.0	0	56.329	240	0.4438	0.657574	
Site2:BlockR1:AA5:BB1	50.0	0	56.329	240	0.8876	0.375626	
Site2:BlockR1:AA5:BB2	0.0	0	0.000	240			
Site2:BlockR2:AA1:BB1	56.7	0	56.329	240	1.0075	0.314726	
Site2:BlockR2:AA1:BB2	-22.3	0	56.329	240	-0.3950	0.693196	
Site2:BlockR2:AA2:BB1	32.5	0	56.329	240	0.5770	0.564505	
Site2:BlockR2:AA2:BB2	-60.0	0	56.329	240	-1.0652	0.287873	
Site2:BlockR2:AA3:BB1	-1.8	0	56.329	240	-0.0311	0.975242	
Site2:BlockR2:AA3:BB2	-42.5	0	56.329	240	-0.7545	0.451295	
Site2:BlockR2:AA4:BB1	22.5	0	56.329	240	0.3994	0.689927	
Site2:BlockR2:AA4:BB2	50.0	0	56.329	240	0.8876	0.375626	
Site2:BlockR2:AA5:BB1	50.0	0	56.329	240	0.8876	0.375626	
Site2:BlockR2:AA5:BB2	0.0	0	0.000	240			
Site2:BlockR3:AA1:BB1	0.0	0	0.000	240			
Site2:BlockR3:AA1:BB2	0.0	0	0.000	240			
Site2:BlockR3:AA2:BB1	0.0	0	0.000	240			
Site2:BlockR3:AA2:BB2	0.0	0	0.000	240			
Site2:BlockR3:AA3:BB1	0.0	0	0.000	240			
Site2:BlockR3:AA3:BB2	0.0	0	0.000	240			

Site2:BlockR3:AA4:BB1	0.0	0	0.000	240		
Site2:BlockR3:AA4:BB2	0.0	0	0.000	240		
Site2:BlockR3:AA5:BB1	0.0	0	0.000	240		
Site2:BlockR3:AA5:BB2	0.0	0	0.000	240		
Site3:BlockR1:AA1:BB1	17.2	0	56.329	240	0.3062	0.759692
Site3:BlockR1:AA1:BB2	-3.8	0	56.329	240	-0.0666	0.946977
Site3:BlockR1:AA2:BB1	4.2	0	56.329	240	0.0754	0.939920
Site3:BlockR1:AA2:BB2	-1.5	0	56.329	240	-0.0266	0.978778
Site3:BlockR1:AA3:BB1	-13.0	0	56.329	240	-0.2308	0.817678
Site3:BlockR1:AA3:BB2	50.0	0	56.329	240	0.8876	0.375626
Site3:BlockR1:AA4:BB1	-18.0	0	56.329	240	-0.3195	0.749589
Site3:BlockR1:AA4:BB2	25.0	0	56.329	240	0.4438	0.657574
Site3:BlockR1:AA5:BB1	0.0	0	56.329	240	0.0000	1.000000
Site3:BlockR1:AA5:BB2	0.0	0	0.000	240		
Site3:BlockR2:AA1:BB1	21.0	0	56.329	240	0.3728	0.709621
Site3:BlockR2:AA1:BB2	15.2	0	56.329	240	0.2707	0.786832
Site3:BlockR2:AA2:BB1	-5.3	0	56.329	240	-0.0932	0.925821
Site3:BlockR2:AA2:BB2	15.7	0	56.329	240	0.2796	0.780021
Site3:BlockR2:AA3:BB1	-22.5	0	56.329	240	-0.3994	0.689927
Site3:BlockR2:AA3:BB2	75.0	0	56.329	240	1.3315	0.184303
Site3:BlockR2:AA4:BB1	-25.8	0	56.329	240	-0.4571	0.647990
Site3:BlockR2:AA4:BB2	25.0	0	56.329	240	0.4438	0.657574
Site3:BlockR2:AA5:BB1	0.0	0	56.329	240	0.0000	1.000000
Site3:BlockR2:AA5:BB2	0.0	0	0.000	240		
Site3:BlockR3:AA1:BB1	0.0	0	0.000	240		
Site3:BlockR3:AA1:BB2	0.0	0	0.000	240		
Site3:BlockR3:AA2:BB1	0.0	0	0.000	240		
Site3:BlockR3:AA2:BB2	0.0	0	0.000	240		
Site3:BlockR3:AA3:BB1	0.0	0	0.000	240		
Site3:BlockR3:AA3:BB2	0.0	0	0.000	240		
Site3:BlockR3:AA4:BB1	0.0	0	0.000	240		
Site3:BlockR3:AA4:BB2	0.0	0	0.000	240		
Site3:BlockR3:AA5:BB1	0.0	0	0.000	240		
Site3:BlockR3:AA5:BB2	0.0	0	0.000	240		
Site4:BlockR1:AA1:BB1	38.7	0	56.329	240	0.6879	0.492169
Site4:BlockR1:AA1:BB2	6.5	0	56.329	240	0.1154	0.908230
Site4:BlockR1:AA2:BB1	17.5	0	56.329	240	0.3107	0.756319
Site4:BlockR1:AA2:BB2	-13.0	0	56.329	240	-0.2308	0.817678
Site4:BlockR1:AA3:BB1	61.5	0	56.329	240	1.0918	0.276020
Site4:BlockR1:AA3:BB2	-32.3	0	56.329	240	-0.5725	0.567503
Site4:BlockR1:AA4:BB1	33.0	0	56.329	240	0.5858	0.558534
Site4:BlockR1:AA4:BB2	25.0	0	56.329	240	0.4438	0.657574
Site4:BlockR1:AA5:BB1	75.0	0	56.329	240	1.3315	0.184303
Site4:BlockR1:AA5:BB2	0.0	0	0.000	240		
Site4:BlockR2:AA1:BB1	-69.8	0	56.329	240	-1.2383	0.216833
Site4:BlockR2:AA1:BB2	-36.5	0	56.329	240	-0.6480	0.517622
Site4:BlockR2:AA2:BB1	-53.8	0	56.329	240	-0.9542	0.340939
Site4:BlockR2:AA2:BB2	-14.3	0	56.329	240	-0.2530	0.800503

Site4:BlockR2:AA3:BB1	-62.3	0	56.329	240	-1.1051	0.270221	
Site4:BlockR2:AA3:BB2	-104.5	0	56.329	240	-1.8552	0.064800	.
Site4:BlockR2:AA4:BB1	-3.8	0	56.329	240	-0.0666	0.946977	
Site4:BlockR2:AA4:BB2	0.0	0	56.329	240	0.0000	1.000000	
Site4:BlockR2:AA5:BB1	25.0	0	56.329	240	0.4438	0.657574	
Site4:BlockR2:AA5:BB2	0.0	0	0.000	240			
Site4:BlockR3:AA1:BB1	0.0	0	0.000	240			
Site4:BlockR3:AA1:BB2	0.0	0	0.000	240			
Site4:BlockR3:AA2:BB1	0.0	0	0.000	240			
Site4:BlockR3:AA2:BB2	0.0	0	0.000	240			
Site4:BlockR3:AA3:BB1	0.0	0	0.000	240			
Site4:BlockR3:AA3:BB2	0.0	0	0.000	240			
Site4:BlockR3:AA4:BB1	0.0	0	0.000	240			
Site4:BlockR3:AA4:BB2	0.0	0	0.000	240			
Site4:BlockR3:AA5:BB1	0.0	0	0.000	240			
Site4:BlockR3:AA5:BB2	0.0	0	0.000	240			
CC1	-1066.7	0	45.993	240	-23.1920	< 2.2e-16	***
CC2	-733.3	0	45.993	240	-15.9445	< 2.2e-16	***
CC3	-533.3	0	45.993	240	-11.5960	< 2.2e-16	***
CC4	0.0	0	0.000	240			
AA1:CC1	1551.3	0	65.044	240	23.8506	< 2.2e-16	***
AA1:CC2	137.7	0	65.044	240	2.1165	0.035330	*
AA1:CC3	201.0	0	65.044	240	3.0902	0.002236	**
AA1:CC4	0.0	0	0.000	240			
AA2:CC1	1877.7	0	65.044	240	28.8678	< 2.2e-16	***
AA2:CC2	1858.7	0	65.044	240	28.5757	< 2.2e-16	***
AA2:CC3	1936.7	0	65.044	240	29.7749	< 2.2e-16	***
AA2:CC4	0.0	0	0.000	240			
AA3:CC1	1915.7	0	65.044	240	29.4520	< 2.2e-16	***
AA3:CC2	1315.7	0	65.044	240	20.2274	< 2.2e-16	***
AA3:CC3	815.7	0	65.044	240	12.5403	< 2.2e-16	***
AA3:CC4	0.0	0	0.000	240			
AA4:CC1	-66.7	0	65.044	240	-1.0250	0.306418	
AA4:CC2	1200.0	0	65.044	240	18.4491	< 2.2e-16	***
AA4:CC3	833.3	0	65.044	240	12.8119	< 2.2e-16	***
AA4:CC4	0.0	0	0.000	240			
AA5:CC1	0.0	0	0.000	240			
AA5:CC2	0.0	0	0.000	240			
AA5:CC3	0.0	0	0.000	240			
AA5:CC4	0.0	0	0.000	240			
BB1:CC1	733.3	0	65.044	240	11.2745	< 2.2e-16	***
BB1:CC2	166.7	0	65.044	240	2.5624	0.011007	*
BB1:CC3	200.0	0	65.044	240	3.0749	0.002350	**
BB1:CC4	0.0	0	0.000	240			
BB2:CC1	0.0	0	0.000	240			
BB2:CC2	0.0	0	0.000	240			
BB2:CC3	0.0	0	0.000	240			
BB2:CC4	0.0	0	0.000	240			

AA1:BB1:CC1	-2102.0	0	91.986	240	-22.8514	< 2.2e-16	***
AA1:BB1:CC2	-122.3	0	91.986	240	-1.3299	0.184808	
AA1:BB1:CC3	-116.7	0	91.986	240	-1.2683	0.205915	
AA1:BB1:CC4	0.0	0	0.000	240			
AA1:BB2:CC1	0.0	0	0.000	240			
AA1:BB2:CC2	0.0	0	0.000	240			
AA1:BB2:CC3	0.0	0	0.000	240			
AA1:BB2:CC4	0.0	0	0.000	240			
AA2:BB1:CC1	-2365.3	0	91.986	240	-25.7142	< 2.2e-16	***
AA2:BB1:CC2	-1887.7	0	91.986	240	-20.5213	< 2.2e-16	***
AA2:BB1:CC3	-1849.3	0	91.986	240	-20.1046	< 2.2e-16	***
AA2:BB1:CC4	0.0	0	0.000	240			
AA2:BB2:CC1	0.0	0	0.000	240			
AA2:BB2:CC2	0.0	0	0.000	240			
AA2:BB2:CC3	0.0	0	0.000	240			
AA2:BB2:CC4	0.0	0	0.000	240			
AA3:BB1:CC1	-4088.7	0	91.986	240	-44.4490	< 2.2e-16	***
AA3:BB1:CC2	-2939.3	0	91.986	240	-31.9543	< 2.2e-16	***
AA3:BB1:CC3	-2384.3	0	91.986	240	-25.9207	< 2.2e-16	***
AA3:BB1:CC4	0.0	0	0.000	240			
AA3:BB2:CC1	0.0	0	0.000	240			
AA3:BB2:CC2	0.0	0	0.000	240			
AA3:BB2:CC3	0.0	0	0.000	240			
AA3:BB2:CC4	0.0	0	0.000	240			
AA4:BB1:CC1	-561.0	0	91.986	240	-6.0988	4.243e-09	***
AA4:BB1:CC2	-1233.3	0	91.986	240	-13.4079	< 2.2e-16	***
AA4:BB1:CC3	-833.3	0	91.986	240	-9.0594	< 2.2e-16	***
AA4:BB1:CC4	0.0	0	0.000	240			
AA4:BB2:CC1	0.0	0	0.000	240			
AA4:BB2:CC2	0.0	0	0.000	240			
AA4:BB2:CC3	0.0	0	0.000	240			
AA4:BB2:CC4	0.0	0	0.000	240			
AA5:BB1:CC1	0.0	0	0.000	240			
AA5:BB1:CC2	0.0	0	0.000	240			
AA5:BB1:CC3	0.0	0	0.000	240			
AA5:BB1:CC4	0.0	0	0.000	240			
AA5:BB2:CC1	0.0	0	0.000	240			
AA5:BB2:CC2	0.0	0	0.000	240			
AA5:BB2:CC3	0.0	0	0.000	240			
AA5:BB2:CC4	0.0	0	0.000	240			
Site1:CC1	100.0	0	65.044	240	1.5374	0.125506	
Site1:CC2	33.3	0	65.044	240	0.5125	0.608789	
Site1:CC3	0.0	0	65.044	240	0.0000	1.000000	
Site1:CC4	0.0	0	0.000	240			
Site2:CC1	133.3	0	65.044	240	2.0499	0.041461	*
Site2:CC2	133.3	0	65.044	240	2.0499	0.041461	*
Site2:CC3	66.7	0	65.044	240	1.0250	0.306418	
Site2:CC4	0.0	0	0.000	240			

Site3:CC1	66.7	0	65.044	240	1.0250	0.306418	
Site3:CC2	0.0	0	65.044	240	0.0000	1.000000	
Site3:CC3	0.0	0	65.044	240	0.0000	1.000000	
Site3:CC4	0.0	0	0.000	240			
Site4:CC1	0.0	0	0.000	240			
Site4:CC2	0.0	0	0.000	240			
Site4:CC3	0.0	0	0.000	240			
Site4:CC4	0.0	0	0.000	240			
Site1:AA1:CC1	-136.7	0	91.986	240	-1.4857	0.138660	
Site1:AA1:CC2	-33.7	0	91.986	240	-0.3660	0.714688	
Site1:AA1:CC3	39.0	0	91.986	240	0.4240	0.671961	
Site1:AA1:CC4	0.0	0	0.000	240			
Site1:AA2:CC1	-173.3	0	91.986	240	-1.8844	0.060726	.
Site1:AA2:CC2	-174.3	0	91.986	240	-1.8952	0.059265	.
Site1:AA2:CC3	0.7	0	91.986	240	0.0072	0.994223	
Site1:AA2:CC4	0.0	0	0.000	240			
Site1:AA3:CC1	-198.7	0	91.986	240	-2.1598	0.031782	*
Site1:AA3:CC2	-132.0	0	91.986	240	-1.4350	0.152587	
Site1:AA3:CC3	-65.3	0	91.986	240	-0.7103	0.478235	
Site1:AA3:CC4	0.0	0	0.000	240			
Site1:AA4:CC1	-33.3	0	91.986	240	-0.3624	0.717390	
Site1:AA4:CC2	0.0	0	91.986	240	0.0000	1.000000	
Site1:AA4:CC3	0.0	0	91.986	240	0.0000	1.000000	
Site1:AA4:CC4	0.0	0	0.000	240			
Site1:AA5:CC1	0.0	0	0.000	240			
Site1:AA5:CC2	0.0	0	0.000	240			
Site1:AA5:CC3	0.0	0	0.000	240			
Site1:AA5:CC4	0.0	0	0.000	240			
Site2:AA1:CC1	-180.3	0	91.986	240	-1.9605	0.051100	.
Site2:AA1:CC2	-81.3	0	91.986	240	-0.8842	0.377475	
Site2:AA1:CC3	-47.0	0	91.986	240	-0.5109	0.609856	
Site2:AA1:CC4	0.0	0	0.000	240			
Site2:AA2:CC1	-196.7	0	91.986	240	-2.1380	0.033526	*
Site2:AA2:CC2	-179.3	0	91.986	240	-1.9496	0.052391	.
Site2:AA2:CC3	-124.7	0	91.986	240	-1.3553	0.176601	
Site2:AA2:CC4	0.0	0	0.000	240			
Site2:AA3:CC1	-85.3	0	91.986	240	-0.9277	0.354505	
Site2:AA3:CC2	-85.3	0	91.986	240	-0.9277	0.354505	
Site2:AA3:CC3	-52.0	0	91.986	240	-0.5653	0.572394	
Site2:AA3:CC4	0.0	0	0.000	240			
Site2:AA4:CC1	-33.3	0	91.986	240	-0.3624	0.717390	
Site2:AA4:CC2	0.0	0	91.986	240	0.0000	1.000000	
Site2:AA4:CC3	33.3	0	91.986	240	0.3624	0.717390	
Site2:AA4:CC4	0.0	0	0.000	240			
Site2:AA5:CC1	0.0	0	0.000	240			
Site2:AA5:CC2	0.0	0	0.000	240			
Site2:AA5:CC3	0.0	0	0.000	240			
Site2:AA5:CC4	0.0	0	0.000	240			

Site3:AA1:CC1	-138.7	0	91.986	240	-1.5075	0.133002
Site3:AA1:CC2	-83.0	0	91.986	240	-0.9023	0.367794
Site3:AA1:CC3	-104.0	0	91.986	240	-1.1306	0.259347
Site3:AA1:CC4	0.0	0	0.000	240		
Site3:AA2:CC1	-61.7	0	91.986	240	-0.6704	0.503251
Site3:AA2:CC2	-71.7	0	91.986	240	-0.7791	0.436684
Site3:AA2:CC3	-68.0	0	91.986	240	-0.7392	0.460480
Site3:AA2:CC4	0.0	0	0.000	240		
Site3:AA3:CC1	-115.7	0	91.986	240	-1.2574	0.209816
Site3:AA3:CC2	-15.7	0	91.986	240	-0.1703	0.864905
Site3:AA3:CC3	-15.7	0	91.986	240	-0.1703	0.864905
Site3:AA3:CC4	0.0	0	0.000	240		
Site3:AA4:CC1	33.3	0	91.986	240	0.3624	0.717390
Site3:AA4:CC2	0.0	0	91.986	240	0.0000	1.000000
Site3:AA4:CC3	33.3	0	91.986	240	0.3624	0.717390
Site3:AA4:CC4	0.0	0	0.000	240		
Site3:AA5:CC1	0.0	0	0.000	240		
Site3:AA5:CC2	0.0	0	0.000	240		
Site3:AA5:CC3	0.0	0	0.000	240		
Site3:AA5:CC4	0.0	0	0.000	240		
Site4:AA1:CC1	0.0	0	0.000	240		
Site4:AA1:CC2	0.0	0	0.000	240		
Site4:AA1:CC3	0.0	0	0.000	240		
Site4:AA1:CC4	0.0	0	0.000	240		
Site4:AA2:CC1	0.0	0	0.000	240		
Site4:AA2:CC2	0.0	0	0.000	240		
Site4:AA2:CC3	0.0	0	0.000	240		
Site4:AA2:CC4	0.0	0	0.000	240		
Site4:AA3:CC1	0.0	0	0.000	240		
Site4:AA3:CC2	0.0	0	0.000	240		
Site4:AA3:CC3	0.0	0	0.000	240		
Site4:AA3:CC4	0.0	0	0.000	240		
Site4:AA4:CC1	0.0	0	0.000	240		
Site4:AA4:CC2	0.0	0	0.000	240		
Site4:AA4:CC3	0.0	0	0.000	240		
Site4:AA4:CC4	0.0	0	0.000	240		
Site4:AA5:CC1	0.0	0	0.000	240		
Site4:AA5:CC2	0.0	0	0.000	240		
Site4:AA5:CC3	0.0	0	0.000	240		
Site4:AA5:CC4	0.0	0	0.000	240		
Site1:BB1:CC1	0.0	0	91.986	240	0.0000	1.000000
Site1:BB1:CC2	33.3	0	91.986	240	0.3624	0.717390
Site1:BB1:CC3	33.3	0	91.986	240	0.3624	0.717390
Site1:BB1:CC4	0.0	0	0.000	240		
Site1:BB2:CC1	0.0	0	0.000	240		
Site1:BB2:CC2	0.0	0	0.000	240		
Site1:BB2:CC3	0.0	0	0.000	240		
Site1:BB2:CC4	0.0	0	0.000	240		

Site2:BB1:CC1	-166.7	0	91.986	240	-1.8119	0.071255	.
Site2:BB1:CC2	-200.0	0	91.986	240	-2.1743	0.030664	*
Site2:BB1:CC3	-233.3	0	91.986	240	-2.5366	0.011827	*
Site2:BB1:CC4	0.0	0	0.000	240			
Site2:BB2:CC1	0.0	0	0.000	240			
Site2:BB2:CC2	0.0	0	0.000	240			
Site2:BB2:CC3	0.0	0	0.000	240			
Site2:BB2:CC4	0.0	0	0.000	240			
Site3:BB1:CC1	33.3	0	91.986	240	0.3624	0.717390	
Site3:BB1:CC2	33.3	0	91.986	240	0.3624	0.717390	
Site3:BB1:CC3	-66.7	0	91.986	240	-0.7248	0.469311	
Site3:BB1:CC4	0.0	0	0.000	240			
Site3:BB2:CC1	0.0	0	0.000	240			
Site3:BB2:CC2	0.0	0	0.000	240			
Site3:BB2:CC3	0.0	0	0.000	240			
Site3:BB2:CC4	0.0	0	0.000	240			
Site4:BB1:CC1	0.0	0	0.000	240			
Site4:BB1:CC2	0.0	0	0.000	240			
Site4:BB1:CC3	0.0	0	0.000	240			
Site4:BB1:CC4	0.0	0	0.000	240			
Site4:BB2:CC1	0.0	0	0.000	240			
Site4:BB2:CC2	0.0	0	0.000	240			
Site4:BB2:CC3	0.0	0	0.000	240			
Site4:BB2:CC4	0.0	0	0.000	240			
Site1:AA1:BB1:CC1	76.3	0	130.087	240	0.5868	0.557899	
Site1:AA1:BB1:CC2	-48.0	0	130.087	240	-0.3690	0.712466	
Site1:AA1:BB1:CC3	-105.3	0	130.087	240	-0.8097	0.418908	
Site1:AA1:BB1:CC4	0.0	0	0.000	240			
Site1:AA1:BB2:CC1	0.0	0	0.000	240			
Site1:AA1:BB2:CC2	0.0	0	0.000	240			
Site1:AA1:BB2:CC3	0.0	0	0.000	240			
Site1:AA1:BB2:CC4	0.0	0	0.000	240			
Site1:AA2:BB1:CC1	12.3	0	130.087	240	0.0948	0.924546	
Site1:AA2:BB1:CC2	120.0	0	130.087	240	0.9225	0.357217	
Site1:AA2:BB1:CC3	-23.7	0	130.087	240	-0.1819	0.855792	
Site1:AA2:BB1:CC4	0.0	0	0.000	240			
Site1:AA2:BB2:CC1	0.0	0	0.000	240			
Site1:AA2:BB2:CC2	0.0	0	0.000	240			
Site1:AA2:BB2:CC3	0.0	0	0.000	240			
Site1:AA2:BB2:CC4	0.0	0	0.000	240			
Site1:AA3:BB1:CC1	202.7	0	130.087	240	1.5579	0.120568	
Site1:AA3:BB1:CC2	100.3	0	130.087	240	0.7713	0.441302	
Site1:AA3:BB1:CC3	29.7	0	130.087	240	0.2281	0.819800	
Site1:AA3:BB1:CC4	0.0	0	0.000	240			
Site1:AA3:BB2:CC1	0.0	0	0.000	240			
Site1:AA3:BB2:CC2	0.0	0	0.000	240			
Site1:AA3:BB2:CC3	0.0	0	0.000	240			
Site1:AA3:BB2:CC4	0.0	0	0.000	240			

Site1:AA4:BB1:CC1	-13.7	0	130.087	240	-0.1051	0.916418	
Site1:AA4:BB1:CC2	-70.0	0	130.087	240	-0.5381	0.591007	
Site1:AA4:BB1:CC3	-66.7	0	130.087	240	-0.5125	0.608789	
Site1:AA4:BB1:CC4	0.0	0	0.000	240			
Site1:AA4:BB2:CC1	0.0	0	0.000	240			
Site1:AA4:BB2:CC2	0.0	0	0.000	240			
Site1:AA4:BB2:CC3	0.0	0	0.000	240			
Site1:AA4:BB2:CC4	0.0	0	0.000	240			
Site1:AA5:BB1:CC1	0.0	0	0.000	240			
Site1:AA5:BB1:CC2	0.0	0	0.000	240			
Site1:AA5:BB1:CC3	0.0	0	0.000	240			
Site1:AA5:BB1:CC4	0.0	0	0.000	240			
Site1:AA5:BB2:CC1	0.0	0	0.000	240			
Site1:AA5:BB2:CC2	0.0	0	0.000	240			
Site1:AA5:BB2:CC3	0.0	0	0.000	240			
Site1:AA5:BB2:CC4	0.0	0	0.000	240			
Site2:AA1:BB1:CC1	215.3	0	130.087	240	1.6553	0.099171	.
Site2:AA1:BB1:CC2	92.7	0	130.087	240	0.7123	0.476945	
Site2:AA1:BB1:CC3	122.0	0	130.087	240	0.9378	0.349274	
Site2:AA1:BB1:CC4	0.0	0	0.000	240			
Site2:AA1:BB2:CC1	0.0	0	0.000	240			
Site2:AA1:BB2:CC2	0.0	0	0.000	240			
Site2:AA1:BB2:CC3	0.0	0	0.000	240			
Site2:AA1:BB2:CC4	0.0	0	0.000	240			
Site2:AA2:BB1:CC1	143.0	0	130.087	240	1.0993	0.272755	
Site2:AA2:BB1:CC2	186.0	0	130.087	240	1.4298	0.154072	
Site2:AA2:BB1:CC3	288.7	0	130.087	240	2.2190	0.027421	*
Site2:AA2:BB1:CC4	0.0	0	0.000	240			
Site2:AA2:BB2:CC1	0.0	0	0.000	240			
Site2:AA2:BB2:CC2	0.0	0	0.000	240			
Site2:AA2:BB2:CC3	0.0	0	0.000	240			
Site2:AA2:BB2:CC4	0.0	0	0.000	240			
Site2:AA3:BB1:CC1	195.7	0	130.087	240	1.5041	0.133866	
Site2:AA3:BB1:CC2	143.0	0	130.087	240	1.0993	0.272755	
Site2:AA3:BB1:CC3	203.3	0	130.087	240	1.5631	0.119358	
Site2:AA3:BB1:CC4	0.0	0	0.000	240			
Site2:AA3:BB2:CC1	0.0	0	0.000	240			
Site2:AA3:BB2:CC2	0.0	0	0.000	240			
Site2:AA3:BB2:CC3	0.0	0	0.000	240			
Site2:AA3:BB2:CC4	0.0	0	0.000	240			
Site2:AA4:BB1:CC1	136.3	0	130.087	240	1.0480	0.295686	
Site2:AA4:BB1:CC2	59.0	0	130.087	240	0.4535	0.650569	
Site2:AA4:BB1:CC3	66.7	0	130.087	240	0.5125	0.608789	
Site2:AA4:BB1:CC4	0.0	0	0.000	240			
Site2:AA4:BB2:CC1	0.0	0	0.000	240			
Site2:AA4:BB2:CC2	0.0	0	0.000	240			
Site2:AA4:BB2:CC3	0.0	0	0.000	240			
Site2:AA4:BB2:CC4	0.0	0	0.000	240			

Site2:AA5:BB1:CC1	0.0	0	0.000	240		
Site2:AA5:BB1:CC2	0.0	0	0.000	240		
Site2:AA5:BB1:CC3	0.0	0	0.000	240		
Site2:AA5:BB1:CC4	0.0	0	0.000	240		
Site2:AA5:BB2:CC1	0.0	0	0.000	240		
Site2:AA5:BB2:CC2	0.0	0	0.000	240		
Site2:AA5:BB2:CC3	0.0	0	0.000	240		
Site2:AA5:BB2:CC4	0.0	0	0.000	240		
Site3:AA1:BB1:CC1	42.0	0	130.087	240	0.3229	0.747082
Site3:AA1:BB1:CC2	-74.0	0	130.087	240	-0.5688	0.569991
Site3:AA1:BB1:CC3	96.3	0	130.087	240	0.7405	0.459703
Site3:AA1:BB1:CC4	0.0	0	0.000	240		
Site3:AA1:BB2:CC1	0.0	0	0.000	240		
Site3:AA1:BB2:CC2	0.0	0	0.000	240		
Site3:AA1:BB2:CC3	0.0	0	0.000	240		
Site3:AA1:BB2:CC4	0.0	0	0.000	240		
Site3:AA2:BB1:CC1	-113.3	0	130.087	240	-0.8712	0.384510
Site3:AA2:BB1:CC2	9.0	0	130.087	240	0.0692	0.944901
Site3:AA2:BB1:CC3	83.7	0	130.087	240	0.6432	0.520736
Site3:AA2:BB1:CC4	0.0	0	0.000	240		
Site3:AA2:BB2:CC1	0.0	0	0.000	240		
Site3:AA2:BB2:CC2	0.0	0	0.000	240		
Site3:AA2:BB2:CC3	0.0	0	0.000	240		
Site3:AA2:BB2:CC4	0.0	0	0.000	240		
Site3:AA3:BB1:CC1	36.3	0	130.087	240	0.2793	0.780255
Site3:AA3:BB1:CC2	-46.7	0	130.087	240	-0.3587	0.720110
Site3:AA3:BB1:CC3	82.0	0	130.087	240	0.6303	0.529068
Site3:AA3:BB1:CC4	0.0	0	0.000	240		
Site3:AA3:BB2:CC1	0.0	0	0.000	240		
Site3:AA3:BB2:CC2	0.0	0	0.000	240		
Site3:AA3:BB2:CC3	0.0	0	0.000	240		
Site3:AA3:BB2:CC4	0.0	0	0.000	240		
Site3:AA4:BB1:CC1	-89.0	0	130.087	240	-0.6842	0.494537
Site3:AA4:BB1:CC2	-100.0	0	130.087	240	-0.7687	0.442819
Site3:AA4:BB1:CC3	33.3	0	130.087	240	0.2562	0.797986
Site3:AA4:BB1:CC4	0.0	0	0.000	240		
Site3:AA4:BB2:CC1	0.0	0	0.000	240		
Site3:AA4:BB2:CC2	0.0	0	0.000	240		
Site3:AA4:BB2:CC3	0.0	0	0.000	240		
Site3:AA4:BB2:CC4	0.0	0	0.000	240		
Site3:AA5:BB1:CC1	0.0	0	0.000	240		
Site3:AA5:BB1:CC2	0.0	0	0.000	240		
Site3:AA5:BB1:CC3	0.0	0	0.000	240		
Site3:AA5:BB1:CC4	0.0	0	0.000	240		
Site3:AA5:BB2:CC1	0.0	0	0.000	240		
Site3:AA5:BB2:CC2	0.0	0	0.000	240		
Site3:AA5:BB2:CC3	0.0	0	0.000	240		
Site3:AA5:BB2:CC4	0.0	0	0.000	240		

```
Site4:AA1:BB1:CC1          0.0         0      0.000 240
Site4:AA1:BB1:CC2          0.0         0      0.000 240
Site4:AA1:BB1:CC3          0.0         0      0.000 240
Site4:AA1:BB1:CC4          0.0         0      0.000 240
Site4:AA1:BB2:CC1          0.0         0      0.000 240
Site4:AA1:BB2:CC2          0.0         0      0.000 240
Site4:AA1:BB2:CC3          0.0         0      0.000 240
Site4:AA1:BB2:CC4          0.0         0      0.000 240
Site4:AA2:BB1:CC1          0.0         0      0.000 240
Site4:AA2:BB1:CC2          0.0         0      0.000 240
Site4:AA2:BB1:CC3          0.0         0      0.000 240
Site4:AA2:BB1:CC4          0.0         0      0.000 240
Site4:AA2:BB2:CC1          0.0         0      0.000 240
Site4:AA2:BB2:CC2          0.0         0      0.000 240
Site4:AA2:BB2:CC3          0.0         0      0.000 240
Site4:AA2:BB2:CC4          0.0         0      0.000 240
Site4:AA3:BB1:CC1          0.0         0      0.000 240
Site4:AA3:BB1:CC2          0.0         0      0.000 240
Site4:AA3:BB1:CC3          0.0         0      0.000 240
Site4:AA3:BB1:CC4          0.0         0      0.000 240
Site4:AA3:BB2:CC1          0.0         0      0.000 240
Site4:AA3:BB2:CC2          0.0         0      0.000 240
Site4:AA3:BB2:CC3          0.0         0      0.000 240
Site4:AA3:BB2:CC4          0.0         0      0.000 240
Site4:AA4:BB1:CC1          0.0         0      0.000 240
Site4:AA4:BB1:CC2          0.0         0      0.000 240
Site4:AA4:BB1:CC3          0.0         0      0.000 240
Site4:AA4:BB1:CC4          0.0         0      0.000 240
Site4:AA4:BB2:CC1          0.0         0      0.000 240
Site4:AA4:BB2:CC2          0.0         0      0.000 240
Site4:AA4:BB2:CC3          0.0         0      0.000 240
Site4:AA4:BB2:CC4          0.0         0      0.000 240
Site4:AA5:BB1:CC1          0.0         0      0.000 240
Site4:AA5:BB1:CC2          0.0         0      0.000 240
Site4:AA5:BB1:CC3          0.0         0      0.000 240
Site4:AA5:BB1:CC4          0.0         0      0.000 240
Site4:AA5:BB2:CC1          0.0         0      0.000 240
Site4:AA5:BB2:CC2          0.0         0      0.000 240
Site4:AA5:BB2:CC3          0.0         0      0.000 240
Site4:AA5:BB2:CC4          0.0         0      0.000 240
---
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

(91) MODEL

```r
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 Estimable Std. Error  Df   t value  Pr(>|t|)
(Intercept)        13975.4         0     35.112 252  398.0266 < 2.2e-16 ***
Site1              -3964.6         0     49.655 252  -79.8426 < 2.2e-16 ***
Site2              -6027.2         0     49.655 252 -121.3814 < 2.2e-16 ***
Site3                  0.0         0      0.000 252
Site1:BlockR1       5969.7         0     39.462 252  151.2767 < 2.2e-16 ***
Site1:BlockR2       3993.2         0     39.462 252  101.1914 < 2.2e-16 ***
Site1:BlockR3       7976.0         0     39.462 252  202.1185 < 2.2e-16 ***
```

Site1:BlockR4	0.0	0	0.000	252			
Site2:BlockR1	1983.1	0	39.462	252	50.2533	< 2.2e-16	***
Site2:BlockR2	8050.7	0	39.462	252	204.0115	< 2.2e-16	***
Site2:BlockR3	9979.6	0	39.462	252	252.8913	< 2.2e-16	***
Site2:BlockR4	0.0	0	0.000	252			
Site3:BlockR1	-1977.8	0	39.462	252	-50.1183	< 2.2e-16	***
Site3:BlockR2	4028.8	0	39.462	252	102.0941	< 2.2e-16	***
Site3:BlockR3	6011.4	0	39.462	252	152.3335	< 2.2e-16	***
Site3:BlockR4	0.0	0	0.000	252			
AA1	-558.7	0	42.242	252	-13.2267	< 2.2e-16	***
AA2	-438.8	0	42.242	252	-10.3889	< 2.2e-16	***
AA3	-240.1	0	42.242	252	-5.6838	3.632e-08	***
AA4	-153.3	0	42.242	252	-3.6279	0.0003458	***
AA5	0.0	0	0.000	252			
Site1:AA1	-38.1	0	59.739	252	-0.6377	0.5242659	
Site1:AA2	0.8	0	59.739	252	0.0131	0.9895761	
Site1:AA3	-98.2	0	59.739	252	-1.6436	0.1015027	
Site1:AA4	-21.4	0	59.739	252	-0.3583	0.7203955	
Site1:AA5	0.0	0	0.000	252			
Site2:AA1	413.1	0	59.739	252	6.9145	3.844e-11	***
Site2:AA2	368.4	0	59.739	252	6.1670	2.752e-09	***
Site2:AA3	138.4	0	59.739	252	2.3163	0.0213427	*
Site2:AA4	164.4	0	59.739	252	2.7516	0.0063618	**
Site2:AA5	0.0	0	0.000	252			
Site3:AA1	0.0	0	0.000	252			
Site3:AA2	0.0	0	0.000	252			
Site3:AA3	0.0	0	0.000	252			
Site3:AA4	0.0	0	0.000	252			
Site3:AA5	0.0	0	0.000	252			
Site1:BlockR1:AA1	-190.6	0	36.024	252	-5.2916	2.635e-07	***
Site1:BlockR1:AA2	-131.1	0	36.024	252	-3.6400	0.0003308	***
Site1:BlockR1:AA3	-76.1	0	36.024	252	-2.1132	0.0355682	*
Site1:BlockR1:AA4	-52.6	0	36.024	252	-1.4608	0.1453053	
Site1:BlockR1:AA5	0.0	0	0.000	252			
Site1:BlockR2:AA1	-188.1	0	36.024	252	-5.2222	3.702e-07	***
Site1:BlockR2:AA2	-148.4	0	36.024	252	-4.1188	5.168e-05	***
Site1:BlockR2:AA3	-43.6	0	36.024	252	-1.2110	0.2270282	
Site1:BlockR2:AA4	-33.0	0	36.024	252	-0.9161	0.3605109	
Site1:BlockR2:AA5	0.0	0	0.000	252			
Site1:BlockR3:AA1	-234.0	0	36.024	252	-6.4957	4.379e-10	***
Site1:BlockR3:AA2	-133.3	0	36.024	252	-3.6989	0.0002658	***
Site1:BlockR3:AA3	-82.1	0	36.024	252	-2.2797	0.0234592	*
Site1:BlockR3:AA4	-87.8	0	36.024	252	-2.4359	0.0155490	*
Site1:BlockR3:AA5	0.0	0	0.000	252			
Site1:BlockR4:AA1	0.0	0	0.000	252			
Site1:BlockR4:AA2	0.0	0	0.000	252			
Site1:BlockR4:AA3	0.0	0	0.000	252			
Site1:BlockR4:AA4	0.0	0	0.000	252			

```
Site1:BlockR4:AA5      0.0         0      0.000 252
Site2:BlockR1:AA1   -382.5         0     36.024 252  -10.6180 < 2.2e-16 ***
Site2:BlockR1:AA2   -261.9         0     36.024 252   -7.2695 4.528e-12 ***
Site2:BlockR1:AA3   -171.6         0     36.024 252   -4.7642 3.204e-06 ***
Site2:BlockR1:AA4    -74.5         0     36.024 252   -2.0681 0.0396533 *
Site2:BlockR1:AA5      0.0         0      0.000 252
Site2:BlockR2:AA1   -634.4         0     36.024 252  -17.6099 < 2.2e-16 ***
Site2:BlockR2:AA2   -508.7         0     36.024 252  -14.1226 < 2.2e-16 ***
Site2:BlockR2:AA3   -288.9         0     36.024 252   -8.0190 3.997e-14 ***
Site2:BlockR2:AA4   -183.6         0     36.024 252   -5.0973 6.768e-07 ***
Site2:BlockR2:AA5      0.0         0      0.000 252
Site2:BlockR3:AA1   -607.5         0     36.024 252  -16.8638 < 2.2e-16 ***
Site2:BlockR3:AA2   -466.6         0     36.024 252  -12.9532 < 2.2e-16 ***
Site2:BlockR3:AA3   -249.6         0     36.024 252   -6.9294 3.517e-11 ***
Site2:BlockR3:AA4   -166.4         0     36.024 252   -4.6185 6.169e-06 ***
Site2:BlockR3:AA5      0.0         0      0.000 252
Site2:BlockR4:AA1      0.0         0      0.000 252
Site2:BlockR4:AA2      0.0         0      0.000 252
Site2:BlockR4:AA3      0.0         0      0.000 252
Site2:BlockR4:AA4      0.0         0      0.000 252
Site2:BlockR4:AA5      0.0         0      0.000 252
Site3:BlockR1:AA1     11.6         0     36.024 252    0.3227 0.7471876
Site3:BlockR1:AA2    -27.1         0     36.024 252   -0.7530 0.4521683
Site3:BlockR1:AA3     -8.9         0     36.024 252   -0.2464 0.8056004
Site3:BlockR1:AA4     51.3         0     36.024 252    1.4227 0.1560685
Site3:BlockR1:AA5      0.0         0      0.000 252
Site3:BlockR2:AA1   -237.6         0     36.024 252   -6.5963 2.463e-10 ***
Site3:BlockR2:AA2   -200.2         0     36.024 252   -5.5588 6.907e-08 ***
Site3:BlockR2:AA3   -142.0         0     36.024 252   -3.9418 0.0001048 ***
Site3:BlockR2:AA4    -55.4         0     36.024 252   -1.5372 0.1255045
Site3:BlockR2:AA5      0.0         0      0.000 252
Site3:BlockR3:AA1   -207.1         0     36.024 252   -5.7497 2.578e-08 ***
Site3:BlockR3:AA2   -232.2         0     36.024 252   -6.4471 5.769e-10 ***
Site3:BlockR3:AA3   -127.7         0     36.024 252   -3.5463 0.0004657 ***
Site3:BlockR3:AA4    -66.9         0     36.024 252   -1.8564 0.0645621 .
Site3:BlockR3:AA5      0.0         0      0.000 252
Site3:BlockR4:AA1      0.0         0      0.000 252
Site3:BlockR4:AA2      0.0         0      0.000 252
Site3:BlockR4:AA3      0.0         0      0.000 252
Site3:BlockR4:AA4      0.0         0      0.000 252
Site3:BlockR4:AA5      0.0         0      0.000 252
BB1                -5364.0         0     45.567 252 -117.7159 < 2.2e-16 ***
BB2                -4564.7         0     45.567 252 -100.1746 < 2.2e-16 ***
BB3                -3808.6         0     45.567 252  -83.5815 < 2.2e-16 ***
BB4                -3070.7         0     45.567 252  -67.3877 < 2.2e-16 ***
BB5                -2308.1         0     45.567 252  -50.6519 < 2.2e-16 ***
BB6                -1561.6         0     45.567 252  -34.2694 < 2.2e-16 ***
BB7                 -704.7         0     45.567 252  -15.4641 < 2.2e-16 ***
```

BB8	0.0	0	0.000	252			
Site1:BB1	-87.2	0	64.441	252	-1.3539	0.1769672	
Site1:BB2	-63.8	0	64.441	252	-0.9900	0.3231006	
Site1:BB3	-48.9	0	64.441	252	-0.7588	0.4486638	
Site1:BB4	-16.6	0	64.441	252	-0.2576	0.7969270	
Site1:BB5	17.3	0	64.441	252	0.2677	0.7891606	
Site1:BB6	16.3	0	64.441	252	0.2529	0.8005184	
Site1:BB7	-127.0	0	64.441	252	-1.9716	0.0497538	*
Site1:BB8	0.0	0	0.000	252			
Site2:BB1	3583.2	0	64.441	252	55.6033	< 2.2e-16	***
Site2:BB2	3099.2	0	64.441	252	48.0926	< 2.2e-16	***
Site2:BB3	2577.7	0	64.441	252	39.9999	< 2.2e-16	***
Site2:BB4	2111.0	0	64.441	252	32.7585	< 2.2e-16	***
Site2:BB5	1589.0	0	64.441	252	24.6581	< 2.2e-16	***
Site2:BB6	1116.0	0	64.441	252	17.3173	< 2.2e-16	***
Site2:BB7	555.1	0	64.441	252	8.6133	8.882e-16	***
Site2:BB8	0.0	0	0.000	252			
Site3:BB1	0.0	0	0.000	252			
Site3:BB2	0.0	0	0.000	252			
Site3:BB3	0.0	0	0.000	252			
Site3:BB4	0.0	0	0.000	252			
Site3:BB5	0.0	0	0.000	252			
Site3:BB6	0.0	0	0.000	252			
Site3:BB7	0.0	0	0.000	252			
Site3:BB8	0.0	0	0.000	252			
Site1:BlockR1:BB1	-1733.0	0	45.567	252	-38.0320	< 2.2e-16	***
Site1:BlockR1:BB2	-1498.6	0	45.567	252	-32.8879	< 2.2e-16	***
Site1:BlockR1:BB3	-1281.4	0	45.567	252	-28.1213	< 2.2e-16	***
Site1:BlockR1:BB4	-984.4	0	45.567	252	-21.6034	< 2.2e-16	***
Site1:BlockR1:BB5	-743.6	0	45.567	252	-16.3189	< 2.2e-16	***
Site1:BlockR1:BB6	-499.4	0	45.567	252	-10.9597	< 2.2e-16	***
Site1:BlockR1:BB7	-196.2	0	45.567	252	-4.3058	2.385e-05	***
Site1:BlockR1:BB8	0.0	0	0.000	252			
Site1:BlockR2:BB1	-1721.2	0	45.567	252	-37.7730	< 2.2e-16	***
Site1:BlockR2:BB2	-1606.0	0	45.567	252	-35.2449	< 2.2e-16	***
Site1:BlockR2:BB3	-1267.6	0	45.567	252	-27.8184	< 2.2e-16	***
Site1:BlockR2:BB4	-1005.4	0	45.567	252	-22.0642	< 2.2e-16	***
Site1:BlockR2:BB5	-800.4	0	45.567	252	-17.5654	< 2.2e-16	***
Site1:BlockR2:BB6	-486.4	0	45.567	252	-10.6744	< 2.2e-16	***
Site1:BlockR2:BB7	-233.8	0	45.567	252	-5.1309	5.761e-07	***
Site1:BlockR2:BB8	0.0	0	0.000	252			
Site1:BlockR3:BB1	-1709.0	0	45.567	252	-37.5053	< 2.2e-16	***
Site1:BlockR3:BB2	-1522.6	0	45.567	252	-33.4146	< 2.2e-16	***
Site1:BlockR3:BB3	-1220.2	0	45.567	252	-26.7782	< 2.2e-16	***
Site1:BlockR3:BB4	-965.2	0	45.567	252	-21.1820	< 2.2e-16	***
Site1:BlockR3:BB5	-767.8	0	45.567	252	-16.8499	< 2.2e-16	***
Site1:BlockR3:BB6	-476.2	0	45.567	252	-10.4506	< 2.2e-16	***
Site1:BlockR3:BB7	-220.2	0	45.567	252	-4.8325	2.345e-06	***

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Site1:BlockR3:BB8      0.0         0      0.000 252
Site1:BlockR4:BB1      0.0         0      0.000 252
Site1:BlockR4:BB2      0.0         0      0.000 252
Site1:BlockR4:BB3      0.0         0      0.000 252
Site1:BlockR4:BB4      0.0         0      0.000 252
Site1:BlockR4:BB5      0.0         0      0.000 252
Site1:BlockR4:BB6      0.0         0      0.000 252
Site1:BlockR4:BB7      0.0         0      0.000 252
Site1:BlockR4:BB8      0.0         0      0.000 252
Site2:BlockR1:BB1  -3519.6         0     45.567 252  -77.2402 < 2.2e-16 ***
Site2:BlockR1:BB2  -3097.8         0     45.567 252  -67.9835 < 2.2e-16 ***
Site2:BlockR1:BB3  -2563.0         0     45.567 252  -56.2469 < 2.2e-16 ***
Site2:BlockR1:BB4  -2044.0         0     45.567 252  -44.8571 < 2.2e-16 ***
Site2:BlockR1:BB5  -1539.6         0     45.567 252  -33.7877 < 2.2e-16 ***
Site2:BlockR1:BB6  -1052.8         0     45.567 252  -23.1045 < 2.2e-16 ***
Site2:BlockR1:BB7   -552.0         0     45.567 252  -12.1141 < 2.2e-16 ***
Site2:BlockR1:BB8      0.0         0      0.000 252
Site2:BlockR2:BB1  -5360.8         0     45.567 252 -117.6467 < 2.2e-16 ***
Site2:BlockR2:BB2  -4648.0         0     45.567 252 -102.0038 < 2.2e-16 ***
Site2:BlockR2:BB3  -3890.2         0     45.567 252  -85.3733 < 2.2e-16 ***
Site2:BlockR2:BB4  -3094.2         0     45.567 252  -67.9045 < 2.2e-16 ***
Site2:BlockR2:BB5  -2335.6         0     45.567 252  -51.2565 < 2.2e-16 ***
Site2:BlockR2:BB6  -1556.2         0     45.567 252  -34.1520 < 2.2e-16 ***
Site2:BlockR2:BB7   -830.8         0     45.567 252  -18.2325 < 2.2e-16 ***
Site2:BlockR2:BB8      0.0         0      0.000 252
Site2:BlockR3:BB1  -5309.4         0     45.567 252 -116.5187 < 2.2e-16 ***
Site2:BlockR3:BB2  -4604.2         0     45.567 252 -101.0426 < 2.2e-16 ***
Site2:BlockR3:BB3  -3827.2         0     45.567 252  -83.9907 < 2.2e-16 ***
Site2:BlockR3:BB4  -3058.2         0     45.567 252  -67.1145 < 2.2e-16 ***
Site2:BlockR3:BB5  -2281.6         0     45.567 252  -50.0714 < 2.2e-16 ***
Site2:BlockR3:BB6  -1466.6         0     45.567 252  -32.1856 < 2.2e-16 ***
Site2:BlockR3:BB7   -795.8         0     45.567 252  -17.4644 < 2.2e-16 ***
Site2:BlockR3:BB8      0.0         0      0.000 252
Site2:BlockR4:BB1      0.0         0      0.000 252
Site2:BlockR4:BB2      0.0         0      0.000 252
Site2:BlockR4:BB3      0.0         0      0.000 252
Site2:BlockR4:BB4      0.0         0      0.000 252
Site2:BlockR4:BB5      0.0         0      0.000 252
Site2:BlockR4:BB6      0.0         0      0.000 252
Site2:BlockR4:BB7      0.0         0      0.000 252
Site2:BlockR4:BB8      0.0         0      0.000 252
Site3:BlockR1:BB1     -7.4         0     45.567 252   -0.1624 0.8711222
Site3:BlockR1:BB2     26.4         0     45.567 252    0.5794 0.5628587
Site3:BlockR1:BB3    -48.4         0     45.567 252   -1.0622 0.2891736
Site3:BlockR1:BB4    -67.6         0     45.567 252   -1.4835 0.1391827
Site3:BlockR1:BB5    -35.0         0     45.567 252   -0.7681 0.4431463
Site3:BlockR1:BB6     -8.2         0     45.567 252   -0.1800 0.8573324
Site3:BlockR1:BB7    -66.6         0     45.567 252   -1.4616 0.1451004
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Site3:BlockR1:BB8      0.0         0      0.000 252
Site3:BlockR2:BB1  -1771.4         0     45.567 252  -38.8747 < 2.2e-16 ***
Site3:BlockR2:BB2  -1533.8         0     45.567 252  -33.6604 < 2.2e-16 ***
Site3:BlockR2:BB3  -1295.8         0     45.567 252  -28.4373 < 2.2e-16 ***
Site3:BlockR2:BB4  -1082.6         0     45.567 252  -23.7585 < 2.2e-16 ***
Site3:BlockR2:BB5   -796.0         0     45.567 252  -17.4688 < 2.2e-16 ***
Site3:BlockR2:BB6   -482.0         0     45.567 252  -10.5778 < 2.2e-16 ***
Site3:BlockR2:BB7   -304.2         0     45.567 252   -6.6759 1.556e-10 ***
Site3:BlockR2:BB8      0.0         0      0.000 252
Site3:BlockR3:BB1  -1772.4         0     45.567 252  -38.8966 < 2.2e-16 ***
Site3:BlockR3:BB2  -1509.0         0     45.567 252  -33.1161 < 2.2e-16 ***
Site3:BlockR3:BB3  -1281.6         0     45.567 252  -28.1257 < 2.2e-16 ***
Site3:BlockR3:BB4  -1013.2         0     45.567 252  -22.2354 < 2.2e-16 ***
Site3:BlockR3:BB5   -751.8         0     45.567 252  -16.4988 < 2.2e-16 ***
Site3:BlockR3:BB6   -462.6         0     45.567 252  -10.1521 < 2.2e-16 ***
Site3:BlockR3:BB7   -248.6         0     45.567 252   -5.4557 1.165e-07 ***
Site3:BlockR3:BB8      0.0         0      0.000 252
Site3:BlockR4:BB1      0.0         0      0.000 252
Site3:BlockR4:BB2      0.0         0      0.000 252
Site3:BlockR4:BB3      0.0         0      0.000 252
Site3:BlockR4:BB4      0.0         0      0.000 252
Site3:BlockR4:BB5      0.0         0      0.000 252
Site3:BlockR4:BB6      0.0         0      0.000 252
Site3:BlockR4:BB7      0.0         0      0.000 252
Site3:BlockR4:BB8      0.0         0      0.000 252
AA1:BB1              -61.5         0     50.945 252   -1.2072 0.2284965
AA1:BB2             -140.0         0     50.945 252   -2.7480 0.0064285 **
AA1:BB3              -57.7         0     50.945 252   -1.1336 0.2580534
AA1:BB4              -29.2         0     50.945 252   -0.5741 0.5663822
AA1:BB5              -66.7         0     50.945 252   -1.3102 0.1913120
AA1:BB6              -41.5         0     50.945 252   -0.8146 0.4160716
AA1:BB7              -40.5         0     50.945 252   -0.7950 0.4273795
AA1:BB8                0.0         0      0.000 252
AA2:BB1              -32.5         0     50.945 252   -0.6379 0.5240931
AA2:BB2              -62.7         0     50.945 252   -1.2317 0.2192050
AA2:BB3              -59.0         0     50.945 252   -1.1581 0.2479183
AA2:BB4               51.8         0     50.945 252    1.0158 0.3107018
AA2:BB5                3.8         0     50.945 252    0.0736 0.9413805
AA2:BB6                8.3         0     50.945 252    0.1619 0.8714843
AA2:BB7                6.3         0     50.945 252    0.1227 0.9024579
AA2:BB8                0.0         0      0.000 252
AA3:BB1              -90.0         0     50.945 252   -1.7666 0.0785061 .
AA3:BB2             -122.7         0     50.945 252   -2.4094 0.0166946 *
AA3:BB3             -110.0         0     50.945 252   -2.1592 0.0317805 *
AA3:BB4              -63.0         0     50.945 252   -1.2366 0.2173799
AA3:BB5              -36.7         0     50.945 252   -0.7214 0.4713562
AA3:BB6              -11.5         0     50.945 252   -0.2257 0.8215928
AA3:BB7             -104.2         0     50.945 252   -2.0463 0.0417637 *
```

AA3:BB8	0.0	0	0.000	252			
AA4:BB1	-66.2	0	50.945	252	-1.3004	0.1946476	
AA4:BB2	-60.2	0	50.945	252	-1.1826	0.2380667	
AA4:BB3	-7.5	0	50.945	252	-0.1472	0.8830788	
AA4:BB4	3.8	0	50.945	252	0.0736	0.9413805	
AA4:BB5	12.0	0	50.945	252	0.2355	0.8139760	
AA4:BB6	14.5	0	50.945	252	0.2846	0.7761701	
AA4:BB7	-37.2	0	50.945	252	-0.7312	0.4653514	
AA4:BB8	0.0	0	0.000	252			
AA5:BB1	0.0	0	0.000	252			
AA5:BB2	0.0	0	0.000	252			
AA5:BB3	0.0	0	0.000	252			
AA5:BB4	0.0	0	0.000	252			
AA5:BB5	0.0	0	0.000	252			
AA5:BB6	0.0	0	0.000	252			
AA5:BB7	0.0	0	0.000	252			
AA5:BB8	0.0	0	0.000	252			
Site1:AA1:BB1	67.2	0	72.048	252	0.9334	0.3515017	
Site1:AA1:BB2	118.7	0	72.048	252	1.6482	0.1005547	
Site1:AA1:BB3	49.7	0	72.048	252	0.6905	0.4905056	
Site1:AA1:BB4	-13.0	0	72.048	252	-0.1804	0.8569552	
Site1:AA1:BB5	77.7	0	72.048	252	1.0791	0.2815539	
Site1:AA1:BB6	10.5	0	72.048	252	0.1457	0.8842456	
Site1:AA1:BB7	48.7	0	72.048	252	0.6766	0.4992577	
Site1:AA1:BB8	0.0	0	0.000	252			
Site1:AA2:BB1	47.5	0	72.048	252	0.6593	0.5103141	
Site1:AA2:BB2	75.5	0	72.048	252	1.0479	0.2956805	
Site1:AA2:BB3	35.2	0	72.048	252	0.4893	0.6250835	
Site1:AA2:BB4	-56.8	0	72.048	252	-0.7877	0.4316280	
Site1:AA2:BB5	-52.5	0	72.048	252	-0.7287	0.4668712	
Site1:AA2:BB6	-57.3	0	72.048	252	-0.7946	0.4275862	
Site1:AA2:BB7	-7.0	0	72.048	252	-0.0972	0.9226782	
Site1:AA2:BB8	0.0	0	0.000	252			
Site1:AA3:BB1	172.0	0	72.048	252	2.3873	0.0177101	*
Site1:AA3:BB2	116.0	0	72.048	252	1.6100	0.1086397	
Site1:AA3:BB3	123.2	0	72.048	252	1.7107	0.0883720	.
Site1:AA3:BB4	21.0	0	72.048	252	0.2915	0.7709287	
Site1:AA3:BB5	64.7	0	72.048	252	0.8987	0.3696645	
Site1:AA3:BB6	-24.3	0	72.048	252	-0.3366	0.7367115	
Site1:AA3:BB7	182.7	0	72.048	252	2.5365	0.0118006	*
Site1:AA3:BB8	0.0	0	0.000	252			
Site1:AA4:BB1	104.5	0	72.048	252	1.4504	0.1481824	
Site1:AA4:BB2	95.7	0	72.048	252	1.3290	0.1850560	
Site1:AA4:BB3	73.2	0	72.048	252	1.0167	0.3102767	
Site1:AA4:BB4	9.7	0	72.048	252	0.1353	0.8924613	
Site1:AA4:BB5	-17.3	0	72.048	252	-0.2394	0.8109707	
Site1:AA4:BB6	-30.5	0	72.048	252	-0.4233	0.6724148	
Site1:AA4:BB7	141.7	0	72.048	252	1.9674	0.0502283	.

Site1:AA4:BB8	0.0	0	0.000	252			
Site1:AA5:BB1	0.0	0	0.000	252			
Site1:AA5:BB2	0.0	0	0.000	252			
Site1:AA5:BB3	0.0	0	0.000	252			
Site1:AA5:BB4	0.0	0	0.000	252			
Site1:AA5:BB5	0.0	0	0.000	252			
Site1:AA5:BB6	0.0	0	0.000	252			
Site1:AA5:BB7	0.0	0	0.000	252			
Site1:AA5:BB8	0.0	0	0.000	252			
Site2:AA1:BB1	-11.8	0	72.048	252	-0.1631	0.8705810	
Site2:AA1:BB2	106.7	0	72.048	252	1.4817	0.1396805	
Site2:AA1:BB3	8.7	0	72.048	252	0.1214	0.9034334	
Site2:AA1:BB4	-57.5	0	72.048	252	-0.7981	0.4255737	
Site2:AA1:BB5	17.5	0	72.048	252	0.2429	0.8082844	
Site2:AA1:BB6	-26.3	0	72.048	252	-0.3643	0.7159080	
Site2:AA1:BB7	-30.0	0	72.048	252	-0.4164	0.6774782	
Site2:AA1:BB8	0.0	0	0.000	252			
Site2:AA2:BB1	-89.5	0	72.048	252	-1.2422	0.2153051	
Site2:AA2:BB2	-74.3	0	72.048	252	-1.0306	0.3037314	
Site2:AA2:BB3	-32.3	0	72.048	252	-0.4476	0.6548116	
Site2:AA2:BB4	-151.8	0	72.048	252	-2.1062	0.0361722	*
Site2:AA2:BB5	-127.5	0	72.048	252	-1.7697	0.0779927	.
Site2:AA2:BB6	-163.5	0	72.048	252	-2.2693	0.0240938	*
Site2:AA2:BB7	-127.5	0	72.048	252	-1.7697	0.0779927	.
Site2:AA2:BB8	0.0	0	0.000	252			
Site2:AA3:BB1	57.7	0	72.048	252	0.8016	0.4235667	
Site2:AA3:BB2	82.0	0	72.048	252	1.1381	0.2561446	
Site2:AA3:BB3	95.2	0	72.048	252	1.3220	0.1873529	
Site2:AA3:BB4	-32.0	0	72.048	252	-0.4442	0.6573149	
Site2:AA3:BB5	60.2	0	72.048	252	0.8363	0.4038052	
Site2:AA3:BB6	-45.0	0	72.048	252	-0.6246	0.5328074	
Site2:AA3:BB7	69.7	0	72.048	252	0.9681	0.3339179	
Site2:AA3:BB8	0.0	0	0.000	252			
Site2:AA4:BB1	-22.3	0	72.048	252	-0.3088	0.7577110	
Site2:AA4:BB2	-49.3	0	72.048	252	-0.6836	0.4948713	
Site2:AA4:BB3	-4.0	0	72.048	252	-0.0555	0.9557691	
Site2:AA4:BB4	-57.8	0	72.048	252	-0.8016	0.4235667	
Site2:AA4:BB5	-81.3	0	72.048	252	-1.1277	0.2605082	
Site2:AA4:BB6	-111.0	0	72.048	252	-1.5406	0.1246574	
Site2:AA4:BB7	-65.5	0	72.048	252	-0.9091	0.3641550	
Site2:AA4:BB8	0.0	0	0.000	252			
Site2:AA5:BB1	0.0	0	0.000	252			
Site2:AA5:BB2	0.0	0	0.000	252			
Site2:AA5:BB3	0.0	0	0.000	252			
Site2:AA5:BB4	0.0	0	0.000	252			
Site2:AA5:BB5	0.0	0	0.000	252			
Site2:AA5:BB6	0.0	0	0.000	252			
Site2:AA5:BB7	0.0	0	0.000	252			

```
Site2:AA5:BB8          0.0         0      0.000 252
Site3:AA1:BB1          0.0         0      0.000 252
Site3:AA1:BB2          0.0         0      0.000 252
Site3:AA1:BB3          0.0         0      0.000 252
Site3:AA1:BB4          0.0         0      0.000 252
Site3:AA1:BB5          0.0         0      0.000 252
Site3:AA1:BB6          0.0         0      0.000 252
Site3:AA1:BB7          0.0         0      0.000 252
Site3:AA1:BB8          0.0         0      0.000 252
Site3:AA2:BB1          0.0         0      0.000 252
Site3:AA2:BB2          0.0         0      0.000 252
Site3:AA2:BB3          0.0         0      0.000 252
Site3:AA2:BB4          0.0         0      0.000 252
Site3:AA2:BB5          0.0         0      0.000 252
Site3:AA2:BB6          0.0         0      0.000 252
Site3:AA2:BB7          0.0         0      0.000 252
Site3:AA2:BB8          0.0         0      0.000 252
Site3:AA3:BB1          0.0         0      0.000 252
Site3:AA3:BB2          0.0         0      0.000 252
Site3:AA3:BB3          0.0         0      0.000 252
Site3:AA3:BB4          0.0         0      0.000 252
Site3:AA3:BB5          0.0         0      0.000 252
Site3:AA3:BB6          0.0         0      0.000 252
Site3:AA3:BB7          0.0         0      0.000 252
Site3:AA3:BB8          0.0         0      0.000 252
Site3:AA4:BB1          0.0         0      0.000 252
Site3:AA4:BB2          0.0         0      0.000 252
Site3:AA4:BB3          0.0         0      0.000 252
Site3:AA4:BB4          0.0         0      0.000 252
Site3:AA4:BB5          0.0         0      0.000 252
Site3:AA4:BB6          0.0         0      0.000 252
Site3:AA4:BB7          0.0         0      0.000 252
Site3:AA4:BB8          0.0         0      0.000 252
Site3:AA5:BB1          0.0         0      0.000 252
Site3:AA5:BB2          0.0         0      0.000 252
Site3:AA5:BB3          0.0         0      0.000 252
Site3:AA5:BB4          0.0         0      0.000 252
Site3:AA5:BB5          0.0         0      0.000 252
Site3:AA5:BB6          0.0         0      0.000 252
Site3:AA5:BB7          0.0         0      0.000 252
Site3:AA5:BB8          0.0         0      0.000 252
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.16 Example 11.1

(92) MODEL

```r
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 .
---
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)       17         0     2.1602 12  7.8695 4.448e-06 ***
R1                -5         0     2.1602 12 -2.3146 0.0391521 *
```

```
R2                 -1         0     2.1602 12 -0.4629 0.6517110
R3                  0         0     0.0000 12
T1                -10         0     3.0551 12 -3.2733 0.0066627 **
T2                  0         0     0.0000 12
R1:T1               4         0     3.0551 12  1.3093 0.2149461
R1:T2               0         0     0.0000 12
R2:T1               2         0     3.0551 12  0.6547 0.5250404
R2:T2               0         0     0.0000 12
R3:T1               0         0     0.0000 12
R3:T2               0         0     0.0000 12
S1                 -8         0     2.4944 12 -3.2071 0.0075321 **
S2                 -9         0     2.4944 12 -3.6080 0.0035926 **
S3                -11         0     2.4944 12 -4.4098 0.0008506 ***
S4                  0         0     0.0000 12
T1:S1               6         0     3.5277 12  1.7008 0.1147185
T1:S2              10         0     3.5277 12  2.8347 0.0150430 *
T1:S3               8         0     3.5277 12  2.2678 0.0426079 *
T1:S4               0         0     0.0000 12
T2:S1               0         0     0.0000 12
T2:S2               0         0     0.0000 12
T2:S3               0         0     0.0000 12
T2:S4               0         0     0.0000 12
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(93) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)      6.0         0    0.91287 12  6.5727 2.641e-05 ***
R1              -2.0         0    0.91287 12 -2.1909  0.048930 *
R2              -1.0         0    0.91287 12 -1.0954  0.294821
R3               0.0         0    0.00000 12
T1              -3.5         0    1.29099 12 -2.7111  0.018917 *
T2               0.0         0    0.00000 12
R1:T1            1.0         0    1.29099 12  0.7746  0.453571
R1:T2            0.0         0    0.00000 12
R2:T1            0.5         0    1.29099 12  0.3873  0.705317
R2:T2            0.0         0    0.00000 12
R3:T1            0.0         0    0.00000 12
R3:T2            0.0         0    0.00000 12
S1              -2.0         0    1.05409 12 -1.8974  0.082097 .
S2              -4.0         0    1.05409 12 -3.7947  0.002554 **
S3              -2.0         0    1.05409 12 -1.8974  0.082097 .
S4               0.0         0    0.00000 12
T1:S1            2.0         0    1.49071 12  1.3416  0.204550
T1:S2            5.0         0    1.49071 12  3.3541  0.005736 **
T1:S3            1.0         0    1.49071 12  0.6708  0.515039
T1:S4            0.0         0    0.00000 12
T2:S1            0.0         0    0.00000 12
T2:S2            0.0         0    0.00000 12
T2:S3            0.0         0    0.00000 12
T2:S4            0.0         0    0.00000 12
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(94) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
```

```
(Intercept)   11.900         0     4.5163 11  2.6349 0.023203 *
R1            -3.300         0     2.4915 11 -1.3245 0.212200
R2            -0.150         0     2.2085 11 -0.0679 0.947069
R3             0.000         0     0.0000 11
T1            -7.025         0     3.7815 11 -1.8577 0.090160 .
T2             0.000         0     0.0000 11
R1:T1          3.150         0     3.0515 11  1.0323 0.324102
R1:T2          0.000         0     0.0000 11
R2:T1          1.575         0     2.9965 11  0.5256 0.609590
R2:T2          0.000         0     0.0000 11
R3:T1          0.000         0     0.0000 11
R3:T2          0.000         0     0.0000 11
S1            -6.300         0     2.7723 11 -2.2725 0.044116 *
S2            -5.600         0     3.6065 11 -1.5528 0.148760
S3            -9.300         0     2.7723 11 -3.3546 0.006425 **
S4             0.000         0     0.0000 11
T1:S1          4.300         0     3.6875 11  1.1661 0.268238
T1:S2          5.750         0     4.7864 11  1.2013 0.254853
T1:S3          7.150         0     3.5025 11  2.0414 0.065946 .
T1:S4          0.000         0     0.0000 11
T2:S1          0.000         0     0.0000 11
T2:S2          0.000         0     0.0000 11
T2:S3          0.000         0     0.0000 11
T2:S4          0.000         0     0.0000 11
Z              0.850         1     0.6659 11  1.2765 0.228074
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.17 Example 11.2

(95) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)  15.3934         0    2.70222  5  5.6966 0.002326 **
Z             1.0219         1    0.27724  5  3.6861 0.014203 *
A1           -4.7497         0    2.49325  5 -1.9050 0.115119
A2            0.0000         0    0.00000  5
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(96) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   10.000         0    0.81490  6 12.2714 1.784e-05 ***
A1            -3.125         0    1.15244  6 -2.7116 0.0350301 *
A2             0.000         0    0.00000  6
A1:sub1        0.000         0    1.03078  6  0.0000 1.0000000
A1:sub2        4.500         0    1.03078  6  4.3656 0.0047414 **
A1:sub3        8.000         0    1.03078  6  7.7611 0.0002406 ***
A1:sub4        0.000         0    0.00000  6
A1:sub5                      0
A1:sub6                      0
A1:sub7                      0
A1:sub8                      0
A2:sub1                      0
A2:sub2                      0
A2:sub3                      0
A2:sub4                      0
A2:sub5        0.000         0    1.03078  6  0.0000 1.0000000
A2:sub6       10.000         0    1.03078  6  9.7014 6.883e-05 ***
A2:sub7        5.000         0    1.03078  6  4.8507 0.0028496 **
A2:sub8        0.000         0    0.00000  6
B1             5.000         0    0.72887  6  6.8599 0.0004725 ***
B2             0.000         0    0.00000  6
A1:B1         -0.750         0    1.03078  6 -0.7276 0.4942562
A1:B2          0.000         0    0.00000  6
A2:B1          0.000         0    0.00000  6
A2:B2          0.000         0    0.00000  6
```

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

(97) 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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)         17         0     2.1602 12  7.8695 4.448e-06 ***
block1              -5         0     2.1602 12 -2.3146 0.0391521 *
block2              -1         0     2.1602 12 -0.4629 0.6517110
block3               0         0     0.0000 12
whole1             -10         0     3.0551 12 -3.2733 0.0066627 **
whole2               0         0     0.0000 12
block1:whole1        4         0     3.0551 12  1.3093 0.2149461
block1:whole2        0         0     0.0000 12
block2:whole1        2         0     3.0551 12  0.6547 0.5250404
block2:whole2        0         0     0.0000 12
block3:whole1        0         0     0.0000 12
block3:whole2        0         0     0.0000 12
split1              -8         0     2.4944 12 -3.2071 0.0075321 **
split2              -9         0     2.4944 12 -3.6080 0.0035926 **
split3             -11         0     2.4944 12 -4.4098 0.0008506 ***
split4               0         0     0.0000 12
whole1:split1        6         0     3.5277 12  1.7008 0.1147185
whole1:split2       10         0     3.5277 12  2.8347 0.0150430 *
whole1:split3        8         0     3.5277 12  2.2678 0.0426079 *
whole1:split4        0         0     0.0000 12
whole2:split1        0         0     0.0000 12
whole2:split2        0         0     0.0000 12
whole2:split3        0         0     0.0000 12
whole2:split4        0         0     0.0000 12
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(98) MODEL

```r
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 Estimable Std. Error Df    t value Pr(>|t|)
(Intercept)          5         0 2.1934e-08 12  227957476   <2e-16 ***
block1              -3         0 2.1934e-08 12 -136774486   <2e-16 ***
block2              -1         0 2.1934e-08 12  -45591495   <2e-16 ***
block3               0         0 0.0000e+00 12
whole1               0         0 3.1019e-08 12          0        1
whole2               0         0 0.0000e+00 12
block1:whole1        0         0 3.1019e-08 12          0        1
block1:whole2        0         0 0.0000e+00 12
block2:whole1       -1         0 3.1019e-08 12  -32238055   <2e-16 ***
block2:whole2        0         0 0.0000e+00 12
block3:whole1        0         0 0.0000e+00 12
block3:whole2        0         0 0.0000e+00 12
split1               0         0 2.5327e-08 12          0        1
split2               0         0 2.5327e-08 12          0        1
split3               0         0 2.5327e-08 12          0        1
split4               0         0 0.0000e+00 12
whole1:split1        0         0 3.5818e-08 12          0        1
whole1:split2        0         0 3.5818e-08 12          0        1
whole1:split3        0         0 3.5818e-08 12          0        1
whole1:split4        0         0 0.0000e+00 12
whole2:split1        0         0 0.0000e+00 12
whole2:split2        0         0 0.0000e+00 12
whole2:split3        0         0 0.0000e+00 12
whole2:split4        0         0 0.0000e+00 12
```

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

(99) 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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)         17         0     2.1602 12  7.8695 4.448e-06 ***
block1              -5         0     2.1602 12 -2.3146 0.0391521 *
block2              -1         0     2.1602 12 -0.4629 0.6517110
block3               0         0     0.0000 12
whole1             -10         0     3.0551 12 -3.2733 0.0066627 **
whole2               0         0     0.0000 12
block1:whole1        4         0     3.0551 12  1.3093 0.2149461
block1:whole2        0         0     0.0000 12
block2:whole1        2         0     3.0551 12  0.6547 0.5250404
block2:whole2        0         0     0.0000 12
block3:whole1        0         0     0.0000 12
block3:whole2        0         0     0.0000 12
split1              -8         0     2.4944 12 -3.2071 0.0075321 **
split2              -9         0     2.4944 12 -3.6080 0.0035926 **
split3             -11         0     2.4944 12 -4.4098 0.0008506 ***
split4               0         0     0.0000 12
whole1:split1        6         0     3.5277 12  1.7008 0.1147185
whole1:split2       10         0     3.5277 12  2.8347 0.0150430 *
whole1:split3        8         0     3.5277 12  2.2678 0.0426079 *
whole1:split4        0         0     0.0000 12
whole2:split1        0         0     0.0000 12
whole2:split2        0         0     0.0000 12
whole2:split3        0         0     0.0000 12
whole2:split4        0         0     0.0000 12
Z                    0         0     0.0000 12
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

7.18 Example 11.3

(100) 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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)   4.5000         0    0.61237  6  7.3485 0.000325 ***
block1       -1.3333         0    0.81650  6 -1.6330 0.153590
block2       -0.3333         0    0.81650  6 -0.4082 0.697261
block3       -0.3333         0    0.81650  6 -0.4082 0.697261
block4        0.0000         0    0.00000  6
A1           -1.0000         0    0.70711  6 -1.4142 0.207031
A2            0.0000         0    0.00000  6
block1:A1     0.6667         0    0.81650  6  0.8165 0.445416
block1:A2     0.0000         0    0.00000  6
block2:A1     0.6667         0    0.81650  6  0.8165 0.445416
block2:A2     0.0000         0    0.00000  6
block3:A1     0.6667         0    0.81650  6  0.8165 0.445416
block3:A2     0.0000         0    0.00000  6
block4:A1     0.0000         0    0.00000  6
block4:A2     0.0000         0    0.00000  6
B1           -0.7500         0    0.79057  6 -0.9487 0.379410
```

```
B2           -1.7500         0    0.79057  6 -2.2136 0.068802 .
B3            0.0000         0    0.00000  6
block1:B1    -0.5000         0    1.00000  6 -0.5000 0.634880
block1:B2     0.5000         0    1.00000  6  0.5000 0.634880
block1:B3     0.0000         0    0.00000  6
block2:B1    -0.5000         0    1.00000  6 -0.5000 0.634880
block2:B2     0.5000         0    1.00000  6  0.5000 0.634880
block2:B3     0.0000         0    0.00000  6
block3:B1     0.0000         0    1.00000  6  0.0000 1.000000
block3:B2     0.0000         0    1.00000  6  0.0000 1.000000
block3:B3     0.0000         0    0.00000  6
block4:B1     0.0000         0    0.00000  6
block4:B2     0.0000         0    0.00000  6
block4:B3     0.0000         0    0.00000  6
A1:B1        -0.5000         0    0.70711  6 -0.7071 0.506021
A1:B2         0.5000         0    0.70711  6  0.7071 0.506021
A1:B3         0.0000         0    0.00000  6
A2:B1         0.0000         0    0.00000  6
A2:B2         0.0000         0    0.00000  6
A2:B3         0.0000         0    0.00000  6
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(101) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)  2.83333         0    0.64550  6  4.3894 0.004621 **
block1       0.00000         0    0.86066  6  0.0000 1.000000
block2       1.83333         0    0.86066  6  2.1301 0.077194 .
block3      -0.16667         0    0.86066  6 -0.1936 0.852840
block4       0.00000         0    0.00000  6
A1          -1.66667         0    0.74536  6 -2.2361 0.066707 .
A2           0.00000         0    0.00000  6
block1:A1    1.00000         0    0.86066  6  1.1619 0.289403
block1:A2    0.00000         0    0.00000  6
block2:A1    0.33333         0    0.86066  6  0.3873 0.711901
block2:A2    0.00000         0    0.00000  6
block3:A1    1.33333         0    0.86066  6  1.5492 0.172308
block3:A2    0.00000         0    0.00000  6
block4:A1    0.00000         0    0.00000  6
block4:A2    0.00000         0    0.00000  6
B1          -0.50000         0    0.83333  6 -0.6000 0.570456
B2          -1.00000         0    0.83333  6 -1.2000 0.275367
B3           0.00000         0    0.00000  6
block1:B1   -2.00000         0    1.05409  6 -1.8974 0.106558
block1:B2    0.00000         0    1.05409  6  0.0000 1.000000
block1:B3    0.00000         0    0.00000  6
block2:B1   -2.00000         0    1.05409  6 -1.8974 0.106558
block2:B2   -0.50000         0    1.05409  6 -0.4743 0.652027
block2:B3    0.00000         0    0.00000  6
block3:B1   -1.00000         0    1.05409  6 -0.9487 0.379410
block3:B2   -0.50000         0    1.05409  6 -0.4743 0.652027
```

```
block3:B3    0.00000         0    0.00000  6
block4:B1    0.00000         0    0.00000  6
block4:B2    0.00000         0    0.00000  6
block4:B3    0.00000         0    0.00000  6
A1:B1        0.00000         0    0.74536  6  0.0000 1.000000
A1:B2        0.00000         0    0.74536  6  0.0000 1.000000
A1:B3        0.00000         0    0.00000  6
A2:B1        0.00000         0    0.00000  6
A2:B2        0.00000         0    0.00000  6
A2:B3        0.00000         0    0.00000  6
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(102) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)  2.94167         0    1.12164  5  2.6227  0.04695 *
block1      -1.33333         0    0.72877  5 -1.8296  0.12684
block2      -1.34167         0    0.96580  5 -1.3892  0.22347
block3      -0.24167         0    0.73105  5 -0.3306  0.75437
block4       0.00000         0    0.00000  5
A1          -0.08333         0    0.85456  5 -0.0975  0.92611
A2           0.00000         0    0.00000  5
block1:A1    0.11667         0    0.80660  5  0.1446  0.89065
block1:A2    0.00000         0    0.00000  5
block2:A1    0.48333         0    0.73783  5  0.6551  0.54135
block2:A2    0.00000         0    0.00000  5
block3:A1   -0.06667         0    0.86230  5 -0.0773  0.94137
block3:A2    0.00000         0    0.00000  5
block4:A1    0.00000         0    0.00000  5
block4:A2    0.00000         0    0.00000  5
B1          -0.47500         0    0.72649  5 -0.6538  0.54210
B2          -1.20000         0    0.78576  5 -1.5272  0.18725
B3           0.00000         0    0.00000  5
block1:B1    0.60000         0    1.12901  5  0.5314  0.61787
block1:B2    0.50000         0    0.89256  5  0.5602  0.59952
block1:B3    0.00000         0    0.00000  5
block2:B1    0.60000         0    1.12901  5  0.5314  0.61787
block2:B2    0.77500         0    0.90914  5  0.8525  0.43289
block2:B3    0.00000         0    0.00000  5
block3:B1    0.55000         0    0.95717  5  0.5746  0.59044
block3:B2    0.27500         0    0.90914  5  0.3025  0.77446
block3:B3    0.00000         0    0.00000  5
block4:B1    0.00000         0    0.00000  5
block4:B2    0.00000         0    0.00000  5
block4:B3    0.00000         0    0.00000  5
A1:B1       -0.50000         0    0.63114  5 -0.7922  0.46414
A1:B2        0.50000         0    0.63114  5  0.7922  0.46414
A1:B3        0.00000         0    0.00000  5
A2:B1        0.00000         0    0.00000  5
A2:B2        0.00000         0    0.00000  5
A2:B3        0.00000         0    0.00000  5
Z            0.55000         1    0.34569  5  1.5910  0.17248
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

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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

(103) 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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)    25.90         0    0.61400  5 42.1822 1.413e-07 ***
brand1         -1.05         0    0.86833  5 -1.2092   0.28063
brand2          2.30         0    0.86833  5  2.6488   0.04549 *
brand3         -2.75         0    0.86833  5 -3.1670   0.02490 *
```

```
brand4          3.20         0    0.86833  5  3.6852   0.01422 *
brand5          0.00         0    0.00000  5
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.1.2 p205

(104) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)  25.9000         0    0.25430 20 101.8496 < 2.2e-16 ***
brand1       -2.0333         0    0.35963 20  -5.6540 1.559e-05 ***
brand2        2.2333         0    0.35963 20   6.2101 4.580e-06 ***
brand3       -2.3667         0    0.35963 20  -6.5808 2.068e-06 ***
```

```
brand4        2.9333         0    0.35963 20   8.1565 8.629e-08 ***
brand5        0.0000         0    0.00000 20
brand1:car1   1.9333         0    0.35963 20   5.3759 2.915e-05 ***
brand1:car2   0.0000         0    0.00000 20
brand2:car1   0.1667         0    0.35963 20   0.4634   0.64805
brand2:car2   0.0000         0    0.00000 20
brand3:car1  -0.8667         0    0.35963 20  -2.4099   0.02571 *
brand3:car2   0.0000         0    0.00000 20
brand4:car1  -0.1333         0    0.35963 20  -0.3708   0.71472
brand4:car2   0.0000         0    0.00000 20
brand5:car1   0.0333         0    0.35963 20   0.0927   0.92707
brand5:car2   0.0000         0    0.00000 20
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.2 Chapter 7

8.2.1 p232

(105) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)    13.35         0    0.50695  5 26.3339 1.476e-06 ***
trtA1           4.85         0    0.71694  5  6.7649 0.0010724 **
trtA2          -0.20         0    0.71694  5 -0.2790 0.7914426
trtB1           5.75         0    0.71694  5  8.0202 0.0004871 ***
trtB2           2.55         0    0.71694  5  3.5568 0.0162698 *
trtC            0.00         0    0.00000  5
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.2.2 p235

(106) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)  16.9667         0    0.47726 10 35.5501 7.362e-12 ***
density10    -4.9667         0    0.67495 10 -7.3586 2.429e-05 ***
density20    -0.9667         0    0.67495 10 -1.4322    0.1826
density30     2.0667         0    0.67495 10  3.0620    0.0120 *
density40     1.0333         0    0.67495 10  1.5310    0.1568
density50     0.0000         0    0.00000 10
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.3 Chapter 8

8.3.1 p265

(107) 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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   2.7154         0    0.81801 11  3.3196 0.0068363 **
trt1          6.2245         0    0.60214 11 10.3374 5.301e-07 ***
trt2          2.9315         0    0.56116 11  5.2239 0.0002838 ***
trt3          0.0000         0    0.00000 11
x             0.7733         1    0.16034 11  4.8230 0.0005333 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.3.2 p272

(108) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)   3.7395         0    1.25360  9  2.9830 0.015375 *
trt1          4.5929         0    1.73483  9  2.6475 0.026586 *
trt2          1.2883         0    1.85702  9  0.6937 0.505359
trt3          0.0000         0    0.00000  9
trt1:x        0.9759         1    0.37622  9  2.5938 0.029031 *
trt2:x        0.8957         1    0.25864  9  3.4630 0.007127 **
trt3:x        0.5448         1    0.26480  9  2.0572 0.069793 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.3.3 p273

(109) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)   3.7395         0    1.25360  9  2.9830  0.01537 *
trt1          4.5929         0    1.73483  9  2.6475  0.02659 *
trt2          1.2883         0    1.85702  9  0.6937  0.50536
trt3          0.0000         0    0.00000  9
x             0.5448         0    0.26480  9  2.0572  0.06979 .
trt1:x        0.4311         0    0.46007  9  0.9370  0.37320
trt2:x        0.3509         0    0.37016  9  0.9481  0.36785
trt3:x        0.0000         0    0.00000  9
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.4 Chapter 9

8.4.1 p344

(110) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   54.357         0     3.4224 20 15.8828 8.344e-13 ***
litter1       19.940         0     3.7490 20  5.3187 3.318e-05 ***
litter2       17.100         0     3.7490 20  4.5612 0.0001897 ***
litter3       20.920         0     3.7490 20  5.5801 1.839e-05 ***
litter4       26.360         0     3.7490 20  7.0312 8.062e-07 ***
litter5       41.040         0     3.7490 20 10.9469 6.767e-10 ***
litter6        0.000         0     0.0000 20
diet1        -12.367         0     3.4224 20 -3.6135 0.0017332 **
diet2         -7.650         0     3.4224 20 -2.2353 0.0369629 *
diet3         -8.100         0     3.4224 20 -2.3668 0.0281448 *
diet4         -6.567         0     3.4224 20 -1.9188 0.0694012 .
diet5          0.000         0     0.0000 20
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.4.2 p349

(111) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)           135.0         0     1.3904 15 97.0913 < 2.2e-16 ***
subject1                0.5         0     1.9664 15  0.2543 0.8027368
subject2                5.0         0     1.9664 15  2.5427 0.0225198 *
subject3               -5.5         0     1.9664 15 -2.7970 0.0135411 *
subject4               10.0         0     1.9664 15  5.0855 0.0001343 ***
subject5                0.0         0     0.0000 15
exercise1             -12.0         0     1.9664 15 -6.1026 2.023e-05 ***
exercise2               0.5         0     1.9664 15  0.2543 0.8027368
exercise3               0.0         0     0.0000 15
subject1:exercise1      4.0         0     2.7809 15  1.4384 0.1708608
subject1:exercise2      0.0         0     2.7809 15  0.0000 1.0000000
subject1:exercise3      0.0         0     0.0000 15
subject2:exercise1      8.0         0     2.7809 15  2.8768 0.0115245 *
subject2:exercise2      2.0         0     2.7809 15  0.7192 0.4830757
subject2:exercise3      0.0         0     0.0000 15
subject3:exercise1      2.0         0     2.7809 15  0.7192 0.4830757
subject3:exercise2      2.0         0     2.7809 15  0.7192 0.4830757
subject3:exercise3      0.0         0     0.0000 15
subject4:exercise1      2.5         0     2.7809 15  0.8990 0.3828608
subject4:exercise2      0.0         0     2.7809 15  0.0000 1.0000000
subject4:exercise3      0.0         0     0.0000 15
subject5:exercise1      0.0         0     0.0000 15
subject5:exercise2      0.0         0     0.0000 15
subject5:exercise3      0.0         0     0.0000 15
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.4.3 p354

(112) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)         191.0         0     3.3198 24 57.5342 < 2.2e-16 ***
loc1                 22.5         0     4.6949 24  4.7925 7.039e-05 ***
```

```
loc2                  0.0         0     0.0000 24
loc1:block1         -20.0         0     4.6949 24 -4.2600 0.0002727 ***
loc1:block2          -8.0         0     4.6949 24 -1.7040 0.1012979
loc1:block3          -9.0         0     4.6949 24 -1.9170 0.0672189 .
loc1:block4           0.0         0     0.0000 24
loc2:block1         -10.5         0     4.6949 24 -2.2365 0.0348764 *
loc2:block2          -4.5         0     4.6949 24 -0.9585 0.3473697
loc2:block3          10.0         0     4.6949 24  2.1300 0.0436248 *
loc2:block4           0.0         0     0.0000 24
HSF1                 -3.0         0     4.6949 24 -0.6390 0.5288766
HSF2                  9.5         0     4.6949 24  2.0235 0.0542951 .
HSF3                  0.0         0     0.0000 24
loc1:HSF1            17.0         0     6.6395 24  2.5604 0.0171697 *
loc1:HSF2            53.5         0     6.6395 24  8.0578 2.778e-08 ***
loc1:HSF3             0.0         0     0.0000 24
loc2:HSF1             0.0         0     0.0000 24
loc2:HSF2             0.0         0     0.0000 24
loc2:HSF3             0.0         0     0.0000 24
loc1:block1:HSF1      8.0         0     6.6395 24  1.2049 0.2399873
loc1:block1:HSF2     -0.5         0     6.6395 24 -0.0753 0.9405950
loc1:block1:HSF3      0.0         0     0.0000 24
loc1:block2:HSF1     -1.5         0     6.6395 24 -0.2259 0.8231768
loc1:block2:HSF2     -0.5         0     6.6395 24 -0.0753 0.9405950
loc1:block2:HSF3      0.0         0     0.0000 24
loc1:block3:HSF1      4.0         0     6.6395 24  0.6025 0.5525233
loc1:block3:HSF2      6.5         0     6.6395 24  0.9790 0.3373533
loc1:block3:HSF3      0.0         0     0.0000 24
loc1:block4:HSF1      0.0         0     0.0000 24
loc1:block4:HSF2      0.0         0     0.0000 24
loc1:block4:HSF3      0.0         0     0.0000 24
loc2:block1:HSF1     -1.0         0     6.6395 24 -0.1506 0.8815396
loc2:block1:HSF2      2.0         0     6.6395 24  0.3012 0.7658364
loc2:block1:HSF3      0.0         0     0.0000 24
loc2:block2:HSF1     -1.5         0     6.6395 24 -0.2259 0.8231768
loc2:block2:HSF2      3.5         0     6.6395 24  0.5271 0.6029315
loc2:block2:HSF3      0.0         0     0.0000 24
loc2:block3:HSF1    -12.0         0     6.6395 24 -1.8074 0.0832589 .
loc2:block3:HSF2    -13.0         0     6.6395 24 -1.9580 0.0619570 .
loc2:block3:HSF3      0.0         0     0.0000 24
loc2:block4:HSF1      0.0         0     0.0000 24
loc2:block4:HSF2      0.0         0     0.0000 24
loc2:block4:HSF3      0.0         0     0.0000 24
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.4.4 p357

(113) MODEL

```r
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 4817.0
---
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 ***
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)    134.0         0     4.1923 10 31.9637 2.114e-11 ***
var1             5.5         0     5.9287 10  0.9277  0.375420
var2             0.0         0     0.0000 10
N1             -17.5         0     5.9287 10 -2.9517  0.014492 *
N2              25.0         0     5.9287 10  4.2167  0.001781 **
N3              20.0         0     5.9287 10  3.3734  0.007081 **
N4               3.5         0     5.9287 10  0.5903  0.568060
N5               0.0         0     0.0000 10
```

```
var1:N1        -13.0         0     8.3845 10 -1.5505  0.152072
var1:N2        -32.5         0     8.3845 10 -3.8762  0.003078 **
var1:N3        -15.5         0     8.3845 10 -1.8486  0.094254 .
var1:N4          7.0         0     8.3845 10  0.8349  0.423286
var1:N5          0.0         0     0.0000 10
var2:N1          0.0         0     0.0000 10
var2:N2          0.0         0     0.0000 10
var2:N3          0.0         0     0.0000 10
var2:N4          0.0         0     0.0000 10
var2:N5          0.0         0     0.0000 10
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.4.5 p361

(114) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)     19.5         0     1.1180  1 17.4413  0.03646 *
block1         -12.0         0     1.4142  1 -8.4853  0.07468 .
block2          -6.0         0     1.4142  1 -4.2426  0.14736
block3           0.0         0     0.0000  1
trt1            16.0         0     1.4142  1 11.3137  0.05612 .
trt2             3.0         0     1.4142  1  2.1213  0.28044
trt3             0.0         0     0.0000  1
---
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, x$X, rx)
```

```
     Estimate  Lower CL Upper CL Std. Error  t value Df   Pr(>|t|)
[1,]     29.5 17.334735 41.66526  0.9574271 30.81175  1 0.02065434
[2,]     16.5  4.334735 28.66526  0.9574271 17.23369  1 0.03689905
[3,]     13.5  1.334735 25.66526  0.9574271 14.10029  1 0.04507394
attr(,"Estimability")
[1] TRUE TRUE TRUE
```

8.5 Chapter 10

8.5.1 p405

(115) 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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   102.16         0     8.7050 12 11.7357 6.195e-08 ***
Row1           12.00         0     7.6348 12  1.5717  0.141991
Row2            4.00         0     7.6348 12  0.5239  0.609878
Row3            6.00         0     7.6348 12  0.7859  0.447183
Row4           -0.40         0     7.6348 12 -0.0524  0.959079
Row5            0.00         0     0.0000 12
Col1            5.80         0     7.6348 12  0.7597  0.462112
Col2           -6.60         0     7.6348 12 -0.8645  0.404285
Col3          -18.80         0     7.6348 12 -2.4624  0.029907 *
Col4           -1.80         0     7.6348 12 -0.2358  0.817593
Col5            0.00         0     0.0000 12
trt1          -25.00         0     7.6348 12 -3.2745  0.006648 **
trt2           -3.20         0     7.6348 12 -0.4191  0.682525
trt3           -7.20         0     7.6348 12 -0.9430  0.364257
trt4           -9.00         0     7.6348 12 -1.1788  0.261321
trt5            0.00         0     0.0000 12
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.5.2 p408

(116) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)     168.500         0    1.02647 15 164.1544 < 2.2e-16 ***
breed1          -19.750         0    1.31735 15 -14.9922 1.956e-10 ***
```

```
breed2            0.000         0    0.00000 15
breed1:farm1      0.500         0    0.99582 15   0.5021 0.6228896
breed1:farm2     -0.500         0    0.99582 15  -0.5021 0.6228896
breed1:farm3      0.500         0    0.99582 15   0.5021 0.6228896
breed1:farm4      0.000         0    0.00000 15
breed2:farm1     -0.750         0    0.99582 15  -0.7531 0.4630208
breed2:farm2     -1.750         0    0.99582 15  -1.7573 0.0992451 .
breed2:farm3     -1.000         0    0.99582 15  -1.0042 0.3312109
breed2:farm4      0.000         0    0.00000 15
wclass1         -10.375         0    0.70415 15 -14.7340 2.498e-10 ***
wclass2          -6.000         0    0.70415 15  -8.5209 3.927e-07 ***
wclass3          -3.125         0    0.70415 15  -4.4379 0.0004791 ***
wclass4           0.000         0    0.00000 15
dosageC          -1.000         0    0.99582 15  -1.0042 0.3312109
dosageH          14.000         0    0.99582 15  14.0587 4.829e-10 ***
dosageL          -0.500         0    0.99582 15  -0.5021 0.6228896
dosageM           0.000         0    0.00000 15
breed1:dosageC    1.750         0    1.40831 15   1.2426 0.2330815
breed1:dosageH   -8.500         0    1.40831 15  -6.0356 2.281e-05 ***
breed1:dosageL    0.750         0    1.40831 15   0.5326 0.6021431
breed1:dosageM    0.000         0    0.00000 15
breed2:dosageC    0.000         0    0.00000 15
breed2:dosageH    0.000         0    0.00000 15
breed2:dosageL    0.000         0    0.00000 15
breed2:dosageM    0.000         0    0.00000 15
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.5.3 p410

(117) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)         52.854         0     2.3407 18 22.5805 1.177e-14 ***
period1             -6.604         0     1.5990 18 -4.1302 0.0006286 ***
period2             -0.083         0     1.2087 18 -0.0689 0.9457953
period3              0.000         0     0.0000 18
sequence1            3.208         0     2.4919 18  1.2875 0.2142212
sequence2           -3.000         0     2.4175 18 -1.2410 0.2305478
sequence3           -6.771         0     2.4919 18 -2.7172 0.0141265 *
sequence4           -1.438         0     2.4919 18 -0.5769 0.5711674
sequence5            1.208         0     2.4919 18  0.4849 0.6335881
sequence6            0.000         0     0.0000 18
sequence1:steer1    -3.667         0     2.4175 18 -1.5167 0.1466983
sequence1:steer2     0.000         0     0.0000 18
sequence1:steer3                   0
sequence1:steer4                   0
sequence1:steer5                   0
sequence1:steer6                   0
sequence1:steer7                   0
sequence1:steer8                   0
sequence1:steer9                   0
```

sequence1:steer10		0				
sequence1:steer11		0				
sequence1:steer12		0				
sequence2:steer1		0				
sequence2:steer2		0				
sequence2:steer3	-4.333	0	2.4175	18	-1.7925	0.0898747 .
sequence2:steer4	0.000	0	0.0000	18		
sequence2:steer5		0				
sequence2:steer6		0				
sequence2:steer7		0				
sequence2:steer8		0				
sequence2:steer9		0				
sequence2:steer10		0				
sequence2:steer11		0				
sequence2:steer12		0				
sequence3:steer1		0				
sequence3:steer2		0				
sequence3:steer3		0				
sequence3:steer4		0				
sequence3:steer5	-3.333	0	2.4175	18	-1.3789	0.1848347
sequence3:steer6	0.000	0	0.0000	18		
sequence3:steer7		0				
sequence3:steer8		0				
sequence3:steer9		0				
sequence3:steer10		0				
sequence3:steer11		0				
sequence3:steer12		0				
sequence4:steer1		0				
sequence4:steer2		0				
sequence4:steer3		0				
sequence4:steer4		0				
sequence4:steer5		0				
sequence4:steer6		0				
sequence4:steer7	-3.333	0	2.4175	18	-1.3789	0.1848347
sequence4:steer8	0.000	0	0.0000	18		
sequence4:steer9		0				
sequence4:steer10		0				
sequence4:steer11		0				
sequence4:steer12		0				
sequence5:steer1		0				
sequence5:steer2		0				
sequence5:steer3		0				
sequence5:steer4		0				
sequence5:steer5		0				
sequence5:steer6		0				
sequence5:steer7		0				
sequence5:steer8		0				
sequence5:steer9	-3.667	0	2.4175	18	-1.5167	0.1466983

```
sequence5:steer10    0.000         0     0.0000 18
sequence5:steer11                  0
sequence5:steer12                  0
sequence6:steer1                   0
sequence6:steer2                   0
sequence6:steer3                   0
sequence6:steer4                   0
sequence6:steer5                   0
sequence6:steer6                   0
sequence6:steer7                   0
sequence6:steer8                   0
sequence6:steer9                   0
sequence6:steer10                  0
sequence6:steer11   -3.333         0     2.4175 18 -1.3789 0.1848347
sequence6:steer12    0.000         0     0.0000 18
trt1                 9.542         0     1.3514 18  7.0606 1.384e-06 ***
trt2                 5.521         0     1.3514 18  4.0853 0.0006946 ***
trt3                 0.000         0     0.0000 18
carry1               0.375         0     1.8131 18  0.2068 0.8384657
carry2              -1.938         0     1.8131 18 -1.0686 0.2993665
carry3               0.000         0     0.0000 18
---
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

(118) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)     727.67         0     8.4885 25 85.7237 < 2.2e-16 ***
VAm             -89.00         0    12.0046 25 -7.4138 9.141e-08 ***
VCo             -30.58         0    12.0046 25 -2.5476 0.0173738 *
VFe             -36.62         0    12.0046 25 -3.0509 0.0053411 **
VHa             -53.37         0    12.0046 25 -4.4462 0.0001566 ***
VPi               0.00         0     0.0000 25
VAm:Block1      -65.00         0    11.6844 25 -5.5630 8.751e-06 ***
VAm:Block2      -70.75         0    11.6844 25 -6.0551 2.512e-06 ***
VAm:Block3      -38.50         0    11.6844 25 -3.2950 0.0029414 **
VAm:Block4      -43.25         0    11.6844 25 -3.7015 0.0010618 **
VAm:Block5      -21.50         0    11.6844 25 -1.8401 0.0776619 .
VAm:Block6        0.00         0     0.0000 25
VCo:Block1      -54.25         0    11.6844 25 -4.6429 9.401e-05 ***
VCo:Block2      -50.75         0    11.6844 25 -4.3434 0.0002043 ***
VCo:Block3      -54.75         0    11.6844 25 -4.6857 8.414e-05 ***
VCo:Block4      -34.25         0    11.6844 25 -2.9313 0.0071180 **
VCo:Block5      -31.50         0    11.6844 25 -2.6959 0.0123750 *
VCo:Block6        0.00         0     0.0000 25
VFe:Block1      -48.00         0    11.6844 25 -4.1080 0.0003752 ***
VFe:Block2      -46.75         0    11.6844 25 -4.0011 0.0004941 ***
VFe:Block3      -43.25         0    11.6844 25 -3.7015 0.0010618 **
VFe:Block4      -31.25         0    11.6844 25 -2.6745 0.0130019 *
VFe:Block5      -10.00         0    11.6844 25 -0.8558 0.4002135
VFe:Block6        0.00         0     0.0000 25
VHa:Block1      -57.00         0    11.6844 25 -4.8783 5.108e-05 ***
VHa:Block2      -74.50         0    11.6844 25 -6.3760 1.127e-06 ***
VHa:Block3      -57.50         0    11.6844 25 -4.9211 4.572e-05 ***
VHa:Block4      -41.25         0    11.6844 25 -3.5304 0.0016360 **
VHa:Block5      -15.50         0    11.6844 25 -1.3266 0.1966467
VHa:Block6        0.00         0     0.0000 25
VPi:Block1      -31.00         0    11.6844 25 -2.6531 0.0136586 *
VPi:Block2      -55.25         0    11.6844 25 -4.7285 7.530e-05 ***
VPi:Block3      -57.75         0    11.6844 25 -4.9425 4.325e-05 ***
VPi:Block4      -37.00         0    11.6844 25 -3.1666 0.0040322 **
```

VPi:Block5	-4.00	0	11.6844	25	-0.3423	0.7349587	
VPi:Block6	0.00	0	0.0000	25			
AF	-14.33	0	10.3047	25	-1.3910	0.1764960	
AM	0.00	0	0.0000	25			
BH	-52.33	0	10.3047	25	-5.0786	3.042e-05	***
BL	0.00	0	0.0000	25			
AF:BH	-5.33	0	7.7896	25	-0.6847	0.4998485	
AF:BL	0.00	0	0.0000	25			
AM:BH	0.00	0	0.0000	25			
AM:BL	0.00	0	0.0000	25			
VAm:AF	34.00	0	14.5730	25	2.3331	0.0279872	*
VAm:AM	0.00	0	0.0000	25			
VCo:AF	-29.83	0	14.5730	25	-2.0472	0.0512888	.
VCo:AM	0.00	0	0.0000	25			
VFe:AF	-26.75	0	14.5730	25	-1.8356	0.0783425	.
VFe:AM	0.00	0	0.0000	25			
VHa:AF	-21.25	0	14.5730	25	-1.4582	0.1572413	
VHa:AM	0.00	0	0.0000	25			
VPi:AF	0.00	0	0.0000	25			
VPi:AM	0.00	0	0.0000	25			
VAm:BH	-5.00	0	14.5730	25	-0.3431	0.7343914	
VAm:BL	0.00	0	0.0000	25			
VCo:BH	-4.83	0	14.5730	25	-0.3317	0.7429077	
VCo:BL	0.00	0	0.0000	25			
VFe:BH	19.25	0	14.5730	25	1.3209	0.1984868	
VFe:BL	0.00	0	0.0000	25			
VHa:BH	-17.25	0	14.5730	25	-1.1837	0.2476668	
VHa:BL	0.00	0	0.0000	25			
VPi:BH	0.00	0	0.0000	25			
VPi:BL	0.00	0	0.0000	25			
VAm:AF:BH	-15.00	0	11.0161	25	-1.3616	0.1854582	
VAm:AF:BL	0.00	0	0.0000	25			
VAm:AM:BH	0.00	0	0.0000	25			
VAm:AM:BL	0.00	0	0.0000	25			
VCo:AF:BH	19.67	0	11.0161	25	1.7853	0.0863588	.
VCo:AF:BL	0.00	0	0.0000	25			
VCo:AM:BH	0.00	0	0.0000	25			
VCo:AM:BL	0.00	0	0.0000	25			
VFe:AF:BH	-12.50	0	11.0161	25	-1.1347	0.2672649	
VFe:AF:BL	0.00	0	0.0000	25			
VFe:AM:BH	0.00	0	0.0000	25			
VFe:AM:BL	0.00	0	0.0000	25			
VHa:AF:BH	15.50	0	11.0161	25	1.4070	0.1717311	
VHa:AF:BL	0.00	0	0.0000	25			
VHa:AM:BH	0.00	0	0.0000	25			
VHa:AM:BL	0.00	0	0.0000	25			
VPi:AF:BH	0.00	0	0.0000	25			
VPi:AF:BL	0.00	0	0.0000	25			

VPi:AM:BH	0.00	0	0.0000	25			
VPi:AM:BL	0.00	0	0.0000	25			
VAm:Block1:AF	-14.00	0	13.4920	25	-1.0377	0.3093639	
VAm:Block1:AM	0.00	0	0.0000	25			
VAm:Block2:AF	-14.50	0	13.4920	25	-1.0747	0.2927668	
VAm:Block2:AM	0.00	0	0.0000	25			
VAm:Block3:AF	-26.00	0	13.4920	25	-1.9271	0.0654087	.
VAm:Block3:AM	0.00	0	0.0000	25			
VAm:Block4:AF	-19.50	0	13.4920	25	-1.4453	0.1607920	
VAm:Block4:AM	0.00	0	0.0000	25			
VAm:Block5:AF	0.00	0	13.4920	25	0.0000	1.0000000	
VAm:Block5:AM	0.00	0	0.0000	25			
VAm:Block6:AF	0.00	0	0.0000	25			
VAm:Block6:AM	0.00	0	0.0000	25			
VCo:Block1:AF	6.50	0	13.4920	25	0.4818	0.6341615	
VCo:Block1:AM	0.00	0	0.0000	25			
VCo:Block2:AF	-10.50	0	13.4920	25	-0.7782	0.4437309	
VCo:Block2:AM	0.00	0	0.0000	25			
VCo:Block3:AF	1.50	0	13.4920	25	0.1112	0.9123636	
VCo:Block3:AM	0.00	0	0.0000	25			
VCo:Block4:AF	-2.50	0	13.4920	25	-0.1853	0.8544925	
VCo:Block4:AM	0.00	0	0.0000	25			
VCo:Block5:AF	21.00	0	13.4920	25	1.5565	0.1321638	
VCo:Block5:AM	0.00	0	0.0000	25			
VCo:Block6:AF	0.00	0	0.0000	25			
VCo:Block6:AM	0.00	0	0.0000	25			
VFe:Block1:AF	20.00	0	13.4920	25	1.4824	0.1507406	
VFe:Block1:AM	0.00	0	0.0000	25			
VFe:Block2:AF	20.50	0	13.4920	25	1.5194	0.1412033	
VFe:Block2:AM	0.00	0	0.0000	25			
VFe:Block3:AF	36.50	0	13.4920	25	2.7053	0.0121084	*
VFe:Block3:AM	0.00	0	0.0000	25			
VFe:Block4:AF	30.50	0	13.4920	25	2.2606	0.0327423	*
VFe:Block4:AM	0.00	0	0.0000	25			
VFe:Block5:AF	17.00	0	13.4920	25	1.2600	0.2193017	
VFe:Block5:AM	0.00	0	0.0000	25			
VFe:Block6:AF	0.00	0	0.0000	25			
VFe:Block6:AM	0.00	0	0.0000	25			
VHa:Block1:AF	2.00	0	13.4920	25	0.1482	0.8833455	
VHa:Block1:AM	0.00	0	0.0000	25			
VHa:Block2:AF	16.00	0	13.4920	25	1.1859	0.2468148	
VHa:Block2:AM	0.00	0	0.0000	25			
VHa:Block3:AF	19.00	0	13.4920	25	1.4082	0.1713737	
VHa:Block3:AM	0.00	0	0.0000	25			
VHa:Block4:AF	-0.50	0	13.4920	25	-0.0371	0.9707322	
VHa:Block4:AM	0.00	0	0.0000	25			
VHa:Block5:AF	-27.00	0	13.4920	25	-2.0012	0.0563396	.
VHa:Block5:AM	0.00	0	0.0000	25			

VHa:Block6:AF	0.00	0	0.0000	25			
VHa:Block6:AM	0.00	0	0.0000	25			
VPi:Block1:AF	-16.00	0	13.4920	25	-1.1859	0.2468148	
VPi:Block1:AM	0.00	0	0.0000	25			
VPi:Block2:AF	-14.50	0	13.4920	25	-1.0747	0.2927668	
VPi:Block2:AM	0.00	0	0.0000	25			
VPi:Block3:AF	-12.50	0	13.4920	25	-0.9265	0.3630565	
VPi:Block3:AM	0.00	0	0.0000	25			
VPi:Block4:AF	-11.00	0	13.4920	25	-0.8153	0.4226006	
VPi:Block4:AM	0.00	0	0.0000	25			
VPi:Block5:AF	-16.00	0	13.4920	25	-1.1859	0.2468148	
VPi:Block5:AM	0.00	0	0.0000	25			
VPi:Block6:AF	0.00	0	0.0000	25			
VPi:Block6:AM	0.00	0	0.0000	25			
VAm:Block1:BH	30.00	0	13.4920	25	2.2235	0.0354473	*
VAm:Block1:BL	0.00	0	0.0000	25			
VAm:Block2:BH	24.50	0	13.4920	25	1.8159	0.0813993	.
VAm:Block2:BL	0.00	0	0.0000	25			
VAm:Block3:BH	4.00	0	13.4920	25	0.2965	0.7693182	
VAm:Block3:BL	0.00	0	0.0000	25			
VAm:Block4:BH	6.50	0	13.4920	25	0.4818	0.6341615	
VAm:Block4:BL	0.00	0	0.0000	25			
VAm:Block5:BH	1.00	0	13.4920	25	0.0741	0.9415063	
VAm:Block5:BL	0.00	0	0.0000	25			
VAm:Block6:BH	0.00	0	0.0000	25			
VAm:Block6:BL	0.00	0	0.0000	25			
VCo:Block1:BH	-12.50	0	13.4920	25	-0.9265	0.3630565	
VCo:Block1:BL	0.00	0	0.0000	25			
VCo:Block2:BH	-4.50	0	13.4920	25	-0.3335	0.7415143	
VCo:Block2:BL	0.00	0	0.0000	25			
VCo:Block3:BH	1.50	0	13.4920	25	0.1112	0.9123636	
VCo:Block3:BL	0.00	0	0.0000	25			
VCo:Block4:BH	-6.50	0	13.4920	25	-0.4818	0.6341615	
VCo:Block4:BL	0.00	0	0.0000	25			
VCo:Block5:BH	4.00	0	13.4920	25	0.2965	0.7693182	
VCo:Block5:BL	0.00	0	0.0000	25			
VCo:Block6:BH	0.00	0	0.0000	25			
VCo:Block6:BL	0.00	0	0.0000	25			
VFe:Block1:BH	-8.00	0	13.4920	25	-0.5929	0.5585441	
VFe:Block1:BL	0.00	0	0.0000	25			
VFe:Block2:BH	-12.50	0	13.4920	25	-0.9265	0.3630565	
VFe:Block2:BL	0.00	0	0.0000	25			
VFe:Block3:BH	-11.50	0	13.4920	25	-0.8524	0.4021071	
VFe:Block3:BL	0.00	0	0.0000	25			
VFe:Block4:BH	0.50	0	13.4920	25	0.0371	0.9707322	
VFe:Block4:BL	0.00	0	0.0000	25			
VFe:Block5:BH	-2.00	0	13.4920	25	-0.1482	0.8833455	
VFe:Block5:BL	0.00	0	0.0000	25			

```
VFe:Block6:BH     0.00         0     0.0000 25
VFe:Block6:BL     0.00         0     0.0000 25
VHa:Block1:BH     8.00         0    13.4920 25  0.5929 0.5585441
VHa:Block1:BL     0.00         0     0.0000 25
VHa:Block2:BH    15.00         0    13.4920 25  1.1118 0.2768138
VHa:Block2:BL     0.00         0     0.0000 25
VHa:Block3:BH    21.00         0    13.4920 25  1.5565 0.1321638
VHa:Block3:BL     0.00         0     0.0000 25
VHa:Block4:BH    33.50         0    13.4920 25  2.4830 0.0200965 *
VHa:Block4:BL     0.00         0     0.0000 25
VHa:Block5:BH    14.00         0    13.4920 25  1.0377 0.3093639
VHa:Block5:BL     0.00         0     0.0000 25
VHa:Block6:BH     0.00         0     0.0000 25
VHa:Block6:BL     0.00         0     0.0000 25
VPi:Block1:BH   -14.00         0    13.4920 25 -1.0377 0.3093639
VPi:Block1:BL     0.00         0     0.0000 25
VPi:Block2:BH    17.50         0    13.4920 25  1.2971 0.2064513
VPi:Block2:BL     0.00         0     0.0000 25
VPi:Block3:BH    24.50         0    13.4920 25  1.8159 0.0813993 .
VPi:Block3:BL     0.00         0     0.0000 25
VPi:Block4:BH     8.00         0    13.4920 25  0.5929 0.5585441
VPi:Block4:BL     0.00         0     0.0000 25
VPi:Block5:BH    -3.00         0    13.4920 25 -0.2224 0.8258445
VPi:Block5:BL     0.00         0     0.0000 25
VPi:Block6:BH     0.00         0     0.0000 25
VPi:Block6:BL     0.00         0     0.0000 25
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.6.2 p434

(119) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)   730.75         0     6.5284 75 111.9335 < 2.2e-16 ***
VAm           -91.42         0     9.2326 75  -9.9015 2.887e-15 ***
VCo           -33.50         0     9.2326 75  -3.6284 0.0005179 ***
VFe           -47.29         0     9.2326 75  -5.1223 2.269e-06 ***
VHa           -64.87         0     9.2326 75  -7.0267 8.274e-10 ***
VPi             0.00         0     0.0000 75
VAm:Block1    -57.00         0     7.5384 75  -7.5613 8.123e-11 ***
VAm:Block2    -65.75         0     7.5384 75  -8.7220 5.032e-13 ***
VAm:Block3    -49.50         0     7.5384 75  -6.5664 5.963e-09 ***
VAm:Block4    -49.75         0     7.5384 75  -6.5996 5.177e-09 ***
VAm:Block5    -21.00         0     7.5384 75  -2.7857 0.0067590 **
VAm:Block6      0.00         0     0.0000 75
```

VCo:Block1	-57.25	0	7.5384	75	-7.5945	7.029e-11	***
VCo:Block2	-58.25	0	7.5384	75	-7.7271	3.938e-11	***
VCo:Block3	-53.25	0	7.5384	75	-7.0638	7.048e-10	***
VCo:Block4	-38.75	0	7.5384	75	-5.1404	2.113e-06	***
VCo:Block5	-19.00	0	7.5384	75	-2.5204	0.0138466	*
VCo:Block6	0.00	0	0.0000	75			
VFe:Block1	-42.00	0	7.5384	75	-5.5715	3.771e-07	***
VFe:Block2	-42.75	0	7.5384	75	-5.6710	2.515e-07	***
VFe:Block3	-30.75	0	7.5384	75	-4.0791	0.0001116	***
VFe:Block4	-15.75	0	7.5384	75	-2.0893	0.0400719	*
VFe:Block5	-2.50	0	7.5384	75	-0.3316	0.7410890	
VFe:Block6	0.00	0	0.0000	75			
VHa:Block1	-52.00	0	7.5384	75	-6.8980	1.441e-09	***
VHa:Block2	-59.00	0	7.5384	75	-7.8266	2.549e-11	***
VHa:Block3	-37.50	0	7.5384	75	-4.9745	4.038e-06	***
VHa:Block4	-24.75	0	7.5384	75	-3.2832	0.0015606	**
VHa:Block5	-22.00	0	7.5384	75	-2.9184	0.0046415	**
VHa:Block6	0.00	0	0.0000	75			
VPi:Block1	-46.00	0	7.5384	75	-6.1021	4.234e-08	***
VPi:Block2	-53.75	0	7.5384	75	-7.1302	5.290e-10	***
VPi:Block3	-51.75	0	7.5384	75	-6.8649	1.662e-09	***
VPi:Block4	-38.50	0	7.5384	75	-5.1072	2.407e-06	***
VPi:Block5	-13.50	0	7.5384	75	-1.7908	0.0773547	.
VPi:Block6	0.00	0	0.0000	75			
AF	-26.00	0	6.1551	75	-4.2242	6.669e-05	***
AM	0.00	0	0.0000	75			
BH	-46.83	0	6.1551	75	-7.6089	6.600e-11	***
BL	0.00	0	0.0000	75			
AF:BH	-5.33	0	8.7046	75	-0.6127	0.5419251	
AF:BL	0.00	0	0.0000	75			
AM:BH	0.00	0	0.0000	75			
AM:BL	0.00	0	0.0000	75			
VAm:AF	33.33	0	8.7046	75	3.8294	0.0002645	***
VAm:AM	0.00	0	0.0000	75			
VCo:AF	-15.50	0	8.7046	75	-1.7807	0.0790155	.
VCo:AM	0.00	0	0.0000	75			
VFe:AF	5.67	0	8.7046	75	0.6510	0.5170370	
VFe:AM	0.00	0	0.0000	75			
VHa:AF	-8.00	0	8.7046	75	-0.9191	0.3610122	
VHa:AM	0.00	0	0.0000	75			
VPi:AF	0.00	0	0.0000	75			
VPi:AM	0.00	0	0.0000	75			
VAm:BH	0.50	0	8.7046	75	0.0574	0.9543466	
VAm:BL	0.00	0	0.0000	75			
VCo:BH	-13.33	0	8.7046	75	-1.5318	0.1297887	
VCo:BL	0.00	0	0.0000	75			
VFe:BH	8.17	0	8.7046	75	0.9382	0.3511512	
VFe:BL	0.00	0	0.0000	75			

```
VHa:BH          -7.50          0     8.7046 75  -0.8616 0.3916454
VHa:BL           0.00          0     0.0000 75
VPi:BH           0.00          0     0.0000 75
VPi:BL           0.00          0     0.0000 75
VAm:AF:BH      -15.00          0    12.3101 75  -1.2185 0.2268497
VAm:AF:BL        0.00          0     0.0000 75
VAm:AM:BH        0.00          0     0.0000 75
VAm:AM:BL        0.00          0     0.0000 75
VCo:AF:BH       19.67          0    12.3101 75   1.5976 0.1143369
VCo:AF:BL        0.00          0     0.0000 75
VCo:AM:BH        0.00          0     0.0000 75
VCo:AM:BL        0.00          0     0.0000 75
VFe:AF:BH      -12.50          0    12.3101 75  -1.0154 0.3131683
VFe:AF:BL        0.00          0     0.0000 75
VFe:AM:BH        0.00          0     0.0000 75
VFe:AM:BL        0.00          0     0.0000 75
VHa:AF:BH       15.50          0    12.3101 75   1.2591 0.2118897
VHa:AF:BL        0.00          0     0.0000 75
VHa:AM:BH        0.00          0     0.0000 75
VHa:AM:BL        0.00          0     0.0000 75
VPi:AF:BH        0.00          0     0.0000 75
VPi:AF:BL        0.00          0     0.0000 75
VPi:AM:BH        0.00          0     0.0000 75
VPi:AM:BL        0.00          0     0.0000 75
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.6.3 p438

(120) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)   730.75         0     6.5284 75 111.9335 < 2.2e-16 ***
VAm           -91.42         0     9.2326 75  -9.9015 2.887e-15 ***
VCo           -33.50         0     9.2326 75  -3.6284 0.0005179 ***
VFe           -47.29         0     9.2326 75  -5.1223 2.269e-06 ***
VHa           -64.87         0     9.2326 75  -7.0267 8.274e-10 ***
VPi             0.00         0     0.0000 75
VAm:Block1    -57.00         0     7.5384 75  -7.5613 8.123e-11 ***
VAm:Block2    -65.75         0     7.5384 75  -8.7220 5.032e-13 ***
VAm:Block3    -49.50         0     7.5384 75  -6.5664 5.963e-09 ***
VAm:Block4    -49.75         0     7.5384 75  -6.5996 5.177e-09 ***
VAm:Block5    -21.00         0     7.5384 75  -2.7857 0.0067590 **
VAm:Block6      0.00         0     0.0000 75
VCo:Block1    -57.25         0     7.5384 75  -7.5945 7.029e-11 ***
VCo:Block2    -58.25         0     7.5384 75  -7.7271 3.938e-11 ***
VCo:Block3    -53.25         0     7.5384 75  -7.0638 7.048e-10 ***
VCo:Block4    -38.75         0     7.5384 75  -5.1404 2.113e-06 ***
VCo:Block5    -19.00         0     7.5384 75  -2.5204 0.0138466 *
VCo:Block6      0.00         0     0.0000 75
VFe:Block1    -42.00         0     7.5384 75  -5.5715 3.771e-07 ***
VFe:Block2    -42.75         0     7.5384 75  -5.6710 2.515e-07 ***
VFe:Block3    -30.75         0     7.5384 75  -4.0791 0.0001116 ***
VFe:Block4    -15.75         0     7.5384 75  -2.0893 0.0400719 *
VFe:Block5     -2.50         0     7.5384 75  -0.3316 0.7410890
VFe:Block6      0.00         0     0.0000 75
VHa:Block1    -52.00         0     7.5384 75  -6.8980 1.441e-09 ***
VHa:Block2    -59.00         0     7.5384 75  -7.8266 2.549e-11 ***
```

```
VHa:Block3    -37.50         0     7.5384 75  -4.9745 4.038e-06 ***
VHa:Block4    -24.75         0     7.5384 75  -3.2832 0.0015606 **
VHa:Block5    -22.00         0     7.5384 75  -2.9184 0.0046415 **
VHa:Block6      0.00         0     0.0000 75
VPi:Block1    -46.00         0     7.5384 75  -6.1021 4.234e-08 ***
VPi:Block2    -53.75         0     7.5384 75  -7.1302 5.290e-10 ***
VPi:Block3    -51.75         0     7.5384 75  -6.8649 1.662e-09 ***
VPi:Block4    -38.50         0     7.5384 75  -5.1072 2.407e-06 ***
VPi:Block5    -13.50         0     7.5384 75  -1.7908 0.0773547 .
VPi:Block6      0.00         0     0.0000 75
C1            -78.17         0     6.1551 75 -12.6996 < 2.2e-16 ***
C2            -26.00         0     6.1551 75  -4.2242 6.669e-05 ***
C3            -46.83         0     6.1551 75  -7.6089 6.600e-11 ***
C4              0.00         0     0.0000 75
VAm:C1         18.83         0     8.7046 75   2.1636 0.0336791 *
VAm:C2         33.33         0     8.7046 75   3.8294 0.0002645 ***
VAm:C3          0.50         0     8.7046 75   0.0574 0.9543466
VAm:C4          0.00         0     0.0000 75
VCo:C1         -9.17         0     8.7046 75  -1.0531 0.2956825
VCo:C2        -15.50         0     8.7046 75  -1.7807 0.0790155 .
VCo:C3        -13.33         0     8.7046 75  -1.5318 0.1297887
VCo:C4          0.00         0     0.0000 75
VFe:C1          1.33         0     8.7046 75   0.1532 0.8786707
VFe:C2          5.67         0     8.7046 75   0.6510 0.5170370
VFe:C3          8.17         0     8.7046 75   0.9382 0.3511512
VFe:C4          0.00         0     0.0000 75
VHa:C1          0.00         0     8.7046 75   0.0000 1.0000000
VHa:C2         -8.00         0     8.7046 75  -0.9191 0.3610122
VHa:C3         -7.50         0     8.7046 75  -0.8616 0.3916454
VHa:C4          0.00         0     0.0000 75
VPi:C1          0.00         0     0.0000 75
VPi:C2          0.00         0     0.0000 75
VPi:C3          0.00         0     0.0000 75
VPi:C4          0.00         0     0.0000 75
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.6.4 p444

(121) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)    720.1         0     5.9862  8 120.2927 2.554e-14 ***
VAm           -107.0         0     7.7282  8 -13.8454 7.159e-07 ***
VCo            -57.0         0     7.7282  8  -7.3756 7.800e-05 ***
VFe            -32.5         0     7.7282  8  -4.2054  0.002975 **
VHa            -65.0         0     7.7282  8  -8.4108 3.040e-05 ***
VPi              0.0         0     0.0000  8
AF             -28.2         0     8.4658  8  -3.3310  0.010368 *
AM               0.0         0     0.0000  8
BH             -48.2         0     4.8877  8  -9.8614 9.419e-06 ***
BL               0.0         0     0.0000  8
AF:BH           -9.6         0     6.9123  8  -1.3888  0.202326
AF:BL            0.0         0     0.0000  8
```

```
AM:BH            0.0         0     0.0000  8
AM:BL            0.0         0     0.0000  8
VAm:AF          42.5         0    10.9293  8   3.8886  0.004618 **
VAm:AM           0.0         0     0.0000  8
VCo:AF          17.0         0    10.9293  8   1.5554  0.158449
VCo:AM           0.0         0     0.0000  8
VFe:AF           0.0         0    10.9293  8   0.0000  1.000000
VFe:AM           0.0         0     0.0000  8
VHa:AF         -24.5         0    10.9293  8  -2.2417  0.055281 .
VHa:AM           0.0         0     0.0000  8
VPi:AF           0.0         0     0.0000  8
VPi:AM           0.0         0     0.0000  8
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.6.5 p482

(122) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)    9.000         0    0.86241 15 10.4359 2.842e-08 ***
block1        -1.375         0    1.11337 15 -1.2350   0.23583
block2         1.125         0    1.11337 15  1.0104   0.32830
block3        -0.125         0    1.11337 15 -0.1123   0.91210
block4         2.875         0    1.11337 15  2.5823   0.02082 *
block5         1.250         0    1.21963 15  1.0249   0.32166
block6         0.000         0    0.00000 15
A0            -0.250         0    0.99582 15 -0.2510   0.80518
A1             0.000         0    0.00000 15
B0            -2.500         0    0.99582 15 -2.5105   0.02400 *
B1             0.000         0    0.00000 15
A0:B0         -1.500         0    1.40831 15 -1.0651   0.30367
A0:B1          0.000         0    0.00000 15
A1:B0          0.000         0    0.00000 15
A1:B1          0.000         0    0.00000 15
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.7 Chapter 12

8.7.1 p525

(123) MODEL

```r
v1p525 = read.table("C:/G/Rt/Kemp/v1p525.txt", head=TRUE)
REG(y ~ x1 + x2 + x3, v1p525)
```

```
            Estimate Std. Error Df  t value  Pr(>|t|)
(Intercept)  14.2125    0.10383 12 136.8787 < 2.2e-16 ***
x1            0.7875    0.10383 12   7.5843 6.465e-06 ***
x2            1.3875    0.10383 12  13.3628 1.446e-08 ***
x3            1.6625    0.10383 12  16.0113 1.839e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
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 87.018
---
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 Df  t value  Pr(>|t|)
(Intercept)  14.2125    0.10383 12 136.8787 < 2.2e-16 ***
x1            0.7875    0.10383 12   7.5843 6.465e-06 ***
x2            1.3875    0.10383 12  13.3628 1.446e-08 ***
x3            1.6625    0.10383 12  16.0113 1.839e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.7.2 p527

(124) MODEL

```r
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 Df t value  Pr(>|t|)
(Intercept)   5.2000    0.48476  7 10.7269 1.345e-05 ***
A             1.1439    0.54471  7  2.1001   0.07386 .
B             1.2626    0.54471  7  2.3180   0.05355 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.7.3 p529

(125) MODEL

```r
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 Df t value Pr(>|t|)
(Intercept)   3.5625    0.72492  6  4.9144 0.002672 **
A             0.9899    0.29801  6  3.3216 0.015973 *
B             1.2626    0.36437  6  3.4652 0.013382 *
I(A * A)      1.0106    0.44003  6  2.2967 0.061374 .
I(B * B)      1.0838    0.48007  6  2.2576 0.064762 .
I(A * B)      1.0500    0.51272  6  2.0479 0.086491 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.8 Chapter 13

8.8.1 p563

(126) 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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   17.250         0     2.3311  9  7.3999 4.104e-05 ***
rep1          19.500         0     2.9486  9  6.6132 9.778e-05 ***
rep2          14.000         0     2.9486  9  4.7480  0.001047 **
rep3          -0.500         0     2.9486  9 -0.1696  0.869099
rep4           0.000         0     0.0000  9
A1             5.375         0     3.2967  9  1.6304  0.137448
A2            11.375         0     3.2967  9  3.4504  0.007270 **
A3             0.000         0     0.0000  9
rep1:A1        1.500         0     4.1700  9  0.3597  0.727358
rep1:A2       -9.000         0     4.1700  9 -2.1583  0.059234 .
rep1:A3        0.000         0     0.0000  9
rep2:A1      -11.000         0     4.1700  9 -2.6379  0.027007 *
rep2:A2      -14.500         0     4.1700  9 -3.4772  0.006969 **
rep2:A3        0.000         0     0.0000  9
rep3:A1        1.000         0     4.1700  9  0.2398  0.815851
rep3:A2       -3.000         0     4.1700  9 -0.7194  0.490137
rep3:A3        0.000         0     0.0000  9
rep4:A1        0.000         0     0.0000  9
rep4:A2        0.000         0     0.0000  9
rep4:A3        0.000         0     0.0000  9
B1             0.500         0     2.0850  9  0.2398  0.815851
B2             0.000         0     0.0000  9
A1:B1          9.250         0     2.9486  9  3.1370  0.011985 *
A1:B2          0.000         0     0.0000  9
A2:B1          7.250         0     2.9486  9  2.4588  0.036232 *
A2:B2          0.000         0     0.0000  9
A3:B1          0.000         0     0.0000  9
A3:B2          0.000         0     0.0000  9
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.8.2 p566

(127) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)   54.500         0     1.3057 12  41.7400 2.309e-14 ***
A1           -23.750         0     1.5992 12 -14.8516 4.354e-09 ***
A2           -18.167         0     1.6857 12 -10.7772 1.586e-07 ***
A3             0.000         0     0.0000 12
B1            -5.500         0     1.8465 12  -2.9785   0.01152 *
B2             0.000         0     0.0000 12
A1:B1          2.250         0     2.2615 12   0.9949   0.33943
A1:B2          0.000         0     0.0000 12
A2:B1          1.167         0     2.3839 12   0.4894   0.63338
A2:B2          0.000         0     0.0000 12
A3:B1          0.000         0     0.0000 12
A3:B2          0.000         0     0.0000 12
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.9 Chapter 14

8.9.1 p581

(128) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)      71.05         0     1.8291 36 38.8445 < 2.2e-16 ***
drug1            -2.95         0     2.5867 36 -1.1404  0.261633
drug2             8.20         0     2.5867 36  3.1700  0.003108 **
drug3             0.00         0     0.0000 36
drug1:person1     7.00         0     2.0450 36  3.4230  0.001559 **
```

```
drug1:person2    10.50         0     2.0450 36  5.1345 9.954e-06 ***
drug1:person3     5.25         0     2.0450 36  2.5673  0.014551 *
drug1:person4     4.75         0     2.0450 36  2.3228  0.025959 *
drug1:person5     0.00         0     0.0000 36
drug2:person1     2.75         0     2.0450 36  1.3448  0.187116
drug2:person2     2.25         0     2.0450 36  1.1003  0.278524
drug2:person3    -7.25         0     2.0450 36 -3.5453  0.001109 **
drug2:person4     2.00         0     2.0450 36  0.9780  0.334599
drug2:person5     0.00         0     0.0000 36
drug3:person1     1.25         0     2.0450 36  0.6113  0.544873
drug3:person2    -3.75         0     2.0450 36 -1.8338  0.074968 .
drug3:person3    16.50         0     2.0450 36  8.0685 1.374e-09 ***
drug3:person4     6.75         0     2.0450 36  3.3008  0.002182 **
drug3:person5     0.00         0     0.0000 36
time1            -1.00         0     1.8291 36 -0.5467  0.587943
time2             0.40         0     1.8291 36  0.2187  0.828128
time3            -0.60         0     1.8291 36 -0.3280  0.744787
time4             0.00         0     0.0000 36
drug1:time1      -0.80         0     2.5867 36 -0.3093  0.758897
drug1:time2       8.60         0     2.5867 36  3.3247  0.002044 **
drug1:time3       9.00         0     2.5867 36  3.4793  0.001334 **
drug1:time4       0.00         0     0.0000 36
drug2:time1       3.20         0     2.5867 36  1.2371  0.224063
drug2:time2       5.00         0     2.5867 36  1.9330  0.061138 .
drug2:time3      -1.00         0     2.5867 36 -0.3866  0.701335
drug2:time4       0.00         0     0.0000 36
drug3:time1       0.00         0     0.0000 36
drug3:time2       0.00         0     0.0000 36
drug3:time3       0.00         0     0.0000 36
drug3:time4       0.00         0     0.0000 36
---
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

(129) 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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)  31.1250         0     2.6116  2 11.9181 0.006967 **
BLOCK1       -7.6875         0     3.4548  2 -2.2252 0.156028
BLOCK2       -4.0625         0     3.4548  2 -1.1759 0.360652
BLOCK3       -1.9375         0     3.4548  2 -0.5608 0.631370
```

```
BLOCK4       -9.3125         0     3.4548  2 -2.6955 0.114475
BLOCK5        0.0000         0     0.0000  2
TRT1        -15.2500         0     3.0156  2 -5.0571 0.036949 *
TRT2         -9.6250         0     3.3715  2 -2.8548 0.103924
TRT3         -3.1250         0     3.3715  2 -0.9269 0.451839
TRT4          0.0000         0     0.0000  2
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.1.2 p62

(130) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)  31.1250         0     2.6116  2 11.9181 0.006967 **
TRT1        -15.2500         0     3.0156  2 -5.0571 0.036949 *
TRT2         -9.6250         0     3.3715  2 -2.8548 0.103924
TRT3         -3.1250         0     3.3715  2 -0.9269 0.451839
```

```
TRT4          0.0000         0     0.0000  2
BLOCK1       -7.6875         0     3.4548  2 -2.2252 0.156028
BLOCK2       -4.0625         0     3.4548  2 -1.1759 0.360652
BLOCK3       -1.9375         0     3.4548  2 -0.5608 0.631370
BLOCK4       -9.3125         0     3.4548  2 -2.6955 0.114475
BLOCK5        0.0000         0     0.0000  2
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.2 Chapter 2

9.2.1 p82

(131) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   42.611         0     2.2418 15 19.0074 6.589e-12 ***
B1            -3.297         0     2.7960 15 -1.1792  0.256667
B2             0.836         0     2.7960 15  0.2990  0.769017
B3            -5.100         0     2.6943 15 -1.8929  0.077835 .
B4             5.497         0     2.7960 15  1.9661  0.068079 .
B5            -0.992         0     2.7960 15 -0.3547  0.727775
B6             2.111         0     2.7960 15  0.7550  0.461919
B7             2.481         0     2.6943 15  0.9207  0.371800
B8             6.131         0     2.6943 15  2.2754  0.037989 *
B9           -10.778         0     2.7960 15 -3.8547  0.001559 **
B10            0.000         0     0.0000 15
Tx1           -3.300         0     2.2418 15 -1.4720  0.161686
Tx2           -5.042         0     2.2418 15 -2.2489  0.039971 *
Tx3           -2.900         0     2.2418 15 -1.2936  0.215373
Tx4           -3.233         0     2.2418 15 -1.4423  0.169778
Tx5           -8.525         0     2.2418 15 -3.8027  0.001734 **
Tx6            0.000         0     0.0000 15
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.2.2 p87

(132) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)  131.100         0    19.3815  4  6.7642 0.002492 **
x1            11.800         0     9.8142  4  1.2023 0.295540
x2           -13.533         0     9.8142  4 -1.3790 0.239998
x3            -5.800         0     9.8142  4 -0.5910 0.586312
x4           -17.467         0     9.8142  4 -1.7797 0.149731
x5            -6.400         0     9.8142  4 -0.6521 0.549902
x6             0.000         0     0.0000  4
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.3 Chapter 6

9.3.1 p217

(133) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)   34.208         0     4.7371 13   7.2214 6.733e-06 ***
R1           -25.542         0     2.5524 13 -10.0069 1.785e-07 ***
R2           -24.167         0     2.5524 13  -9.4682 3.379e-07 ***
R3           -12.458         0     2.5524 13  -4.8810 0.0003001 ***
R4             0.000         0     0.0000 13
C1             3.000         0     4.1681 13   0.7198 0.4844133
C2             1.444         0     4.1681 13   0.3466 0.7344740
C3             5.000         0     4.1681 13   1.1996 0.2517026
C4             1.556         0     4.1681 13   0.3732 0.7150083
C5             0.778         0     4.1681 13   0.1866 0.8548516
C6             6.333         0     4.1681 13   1.5195 0.1525804
C7             2.889         0     4.1681 13   0.6931 0.5004420
C8             5.000         0     4.1681 13   1.1996 0.2517026
C9             0.000         0     0.0000 13
Tx1            6.569         0     4.6859 13   1.4020 0.1843467
Tx2            7.398         0     4.6859 13   1.5788 0.1383906
Tx3            6.731         0     4.6859 13   1.4366 0.1744722
Tx4            5.366         0     4.6859 13   1.1451 0.2728148
Tx5            4.477         0     4.6859 13   0.9554 0.3568064
Tx6            8.556         0     4.8129 13   1.7776 0.0988490 .
Tx7            6.347         0     4.6859 13   1.3545 0.1986361
Tx8            5.032         0     4.6859 13   1.0740 0.3023722
Tx9            6.458         0     4.6859 13   1.3783 0.1913817
```

```
Tx10           8.444         0     4.8129 13   1.7546 0.1028594
Tx11           0.620         0     4.6859 13   0.1324 0.8967013
Tx12           0.000         0     0.0000 13
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.3.2 p234

(134) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)   36.375         0     2.0117  2 18.0819 0.003045 **
C1             0.250         0     1.8625  2  0.1342 0.905509
```

```
C2             2.250         0     1.8625  2  1.2081 0.350481
C3             0.000         0     2.1506  2  0.0000 1.000000
C4             0.000         0     0.0000  2
R1            -9.500         0     1.8625  2 -5.1008 0.036352 *
R2            -6.000         0     1.8625  2 -3.2215 0.084343 .
R3             1.000         0     2.1506  2  0.4650 0.687652
R4             0.000         0     0.0000  2
Tx1           -6.250         0     2.6339  2 -2.3729 0.140990
Tx2           -6.750         0     2.8449  2 -2.3726 0.141016
Tx3           -1.500         0     2.6339  2 -0.5695 0.626456
Tx4           -3.000         0     2.4044  2 -1.2477 0.338419
Tx5           -2.750         0     2.8449  2 -0.9666 0.435712
Tx6           -5.250         0     2.6339  2 -1.9932 0.184428
Tx7           -4.500         0     2.8449  2 -1.5817 0.254516
Tx8            0.000         0     0.0000  2
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.4 Chapter 7

9.4.1 p268

(135) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   10.938         0     2.3356  7  4.6830  0.002253 **
block         13.375         1     1.1329  7 11.8059 7.093e-06 ***
A0            -4.500         0     2.2658  7 -1.9860  0.087400 .
A1             0.000         0     0.0000  7
B0             1.000         0     2.2658  7  0.4413  0.672276
B1             0.000         0     0.0000  7
A0:B0          0.500         0     3.2043  7  0.1560  0.880408
A0:B1          0.000         0     0.0000  7
A1:B0          0.000         0     0.0000  7
A1:B1          0.000         0     0.0000  7
C0            -7.000         0     2.2658  7 -3.0894  0.017582 *
C1             0.000         0     0.0000  7
A0:C0          1.500         0     3.2043  7  0.4681  0.653929
A0:C1          0.000         0     0.0000  7
A1:C0          0.000         0     0.0000  7
A1:C1          0.000         0     0.0000  7
B0:C0         -1.500         0     3.2043  7 -0.4681  0.653929
B0:C1          0.000         0     0.0000  7
B1:C0          0.000         0     0.0000  7
```

```
B1:C1          0.000         0     0.0000  7
A0:B0:C0      -2.500         0     4.5316  7 -0.5517  0.598331
A0:B0:C1       0.000         0     0.0000  7
A0:B1:C0       0.000         0     0.0000  7
A0:B1:C1       0.000         0     0.0000  7
A1:B0:C0       0.000         0     0.0000  7
A1:B0:C1       0.000         0     0.0000  7
A1:B1:C0       0.000         0     0.0000  7
A1:B1:C1       0.000         0     0.0000  7
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.4.2 p273

(136) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)         41.0         0    0.76035 16  53.9229 < 2.2e-16 ***
block1             -18.5         0    1.07529 16 -17.2047 9.615e-12 ***
block2               0.0         0    0.00000 16
A0                  -6.5         0    1.07529 16  -6.0449 1.702e-05 ***
A1                   0.0         0    0.00000 16
B0                  -2.0         0    1.07529 16  -1.8600 0.0813758 .
B1                   0.0         0    0.00000 16
A0:B0                3.5         0    1.52069 16   2.3016 0.0351358 *
A0:B1                0.0         0    0.00000 16
A1:B0                0.0         0    0.00000 16
A1:B1                0.0         0    0.00000 16
C0                  -9.5         0    1.07529 16  -8.8348 1.495e-07 ***
C1                   0.0         0    0.00000 16
A0:C0                2.5         0    1.52069 16   1.6440 0.1196805
A0:C1                0.0         0    0.00000 16
A1:C0                0.0         0    0.00000 16
A1:C1                0.0         0    0.00000 16
B0:C0               -3.0         0    1.52069 16  -1.9728 0.0660548 .
B0:C1                0.0         0    0.00000 16
B1:C0                0.0         0    0.00000 16
B1:C1                0.0         0    0.00000 16
A0:B0:C0            -1.0         0    2.15058 16  -0.4650 0.6482037
A0:B0:C1             0.0         0    0.00000 16
A0:B1:C0             0.0         0    0.00000 16
```

```
A0:B1:C1              0.0         0    0.00000 16
A1:B0:C0              0.0         0    0.00000 16
A1:B0:C1              0.0         0    0.00000 16
A1:B1:C0              0.0         0    0.00000 16
A1:B1:C1              0.0         0    0.00000 16
block1:A0:B0:C0       7.0         0    1.52069 16   4.6032 0.0002938 ***
block1:A0:B0:C1       4.0         0    1.52069 16   2.6304 0.0181818 *
block1:A0:B1:C0       3.5         0    1.52069 16   2.3016 0.0351358 *
block1:A0:B1:C1       3.5         0    1.52069 16   2.3016 0.0351358 *
block1:A1:B0:C0      13.0         0    1.52069 16   8.5487 2.321e-07 ***
block1:A1:B0:C1       3.5         0    1.52069 16   2.3016 0.0351358 *
block1:A1:B1:C0       4.0         0    1.52069 16   2.6304 0.0181818 *
block1:A1:B1:C1       0.0         0    0.00000 16
block2:A0:B0:C0       0.0         0    0.00000 16
block2:A0:B0:C1       0.0         0    0.00000 16
block2:A0:B1:C0       0.0         0    0.00000 16
block2:A0:B1:C1       0.0         0    0.00000 16
block2:A1:B0:C0       0.0         0    0.00000 16
block2:A1:B0:C1       0.0         0    0.00000 16
block2:A1:B1:C0       0.0         0    0.00000 16
block2:A1:B1:C1       0.0         0    0.00000 16
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.5 Chapter 8

9.5.1 p304

(137) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)   35.625         0    0.44194  6  80.6102 2.454e-10 ***
rep1         -10.250         0    0.39528  6 -25.9307 2.169e-07 ***
rep2           0.000         0    0.00000  6
rep1:block1    1.750         0    0.39528  6   4.4272  0.004436 **
rep1:block2    0.000         0    0.00000  6
rep1:block3                  0
rep1:block4                  0
rep2:block1                  0
rep2:block2                  0
rep2:block3    1.000         0    0.39528  6   2.5298  0.044690 *
rep2:block4    0.000         0    0.00000  6
A0            -2.375         0    0.48412  6  -4.9058  0.002695 **
A1             0.000         0    0.00000  6
```

```
B0            -9.875         0    0.48412  6 -20.3977 9.026e-07 ***
B1             0.000         0    0.00000  6
A0:B0          0.250         0    0.55902  6   0.4472  0.670412
A0:B1          0.000         0    0.00000  6
A1:B0          0.000         0    0.00000  6
A1:B1          0.000         0    0.00000  6
C0            -7.375         0    0.48412  6 -15.2337 5.051e-06 ***
C1             0.000         0    0.00000  6
A0:C0          0.250         0    0.55902  6   0.4472  0.670412
A0:C1          0.000         0    0.00000  6
A1:C0          0.000         0    0.00000  6
A1:C1          0.000         0    0.00000  6
B0:C0          6.250         0    0.55902  6  11.1803 3.056e-05 ***
B0:C1          0.000         0    0.00000  6
B1:C0          0.000         0    0.00000  6
B1:C1          0.000         0    0.00000  6
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.5.2 p309

(138) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)         35         0             0
rep1                -9         0             0
rep2                 0         0             0
A0                  -1         0             0
A1                   0         0             0
rep1:A0              0         0             0
rep1:A1              0         0             0
rep2:A0              0         0             0
rep2:A1              0         0             0
```

B0	-8	0	0
B1	0	0	0
rep1:B0	-1	0	0
rep1:B1	0	0	0
rep2:B0	0	0	0
rep2:B1	0	0	0
A0:B0	-2	0	0
A0:B1	0	0	0
A1:B0	0	0	0
A1:B1	0	0	0
rep1:A0:B0	-1	0	0
rep1:A0:B1	0	0	0
rep1:A1:B0	0	0	0
rep1:A1:B1	0	0	0
rep2:A0:B0	0	0	0
rep2:A0:B1	0	0	0
rep2:A1:B0	0	0	0
rep2:A1:B1	0	0	0
C0	-6	0	0
C1	0	0	0
rep1:C0	0	0	0
rep1:C1	0	0	0
rep2:C0	0	0	0
rep2:C1	0	0	0
A0:C0	-2	0	0
A0:C1	0	0	0
A1:C0	0	0	0
A1:C1	0	0	0
rep1:A0:C0	-1	0	0
rep1:A0:C1	0	0	0
rep1:A1:C0	0	0	0
rep1:A1:C1	0	0	0
rep2:A0:C0	0	0	0
rep2:A0:C1	0	0	0
rep2:A1:C0	0	0	0
rep2:A1:C1	0	0	0
B0:C0	4	0	0
B0:C1	0	0	0
B1:C0	0	0	0
B1:C1	0	0	0
rep1:B0:C0	-1	0	0
rep1:B0:C1	0	0	0
rep1:B1:C0	0	0	0
rep1:B1:C1	0	0	0
rep2:B0:C0	0	0	0
rep2:B0:C1	0	0	0
rep2:B1:C0	0	0	0
rep2:B1:C1	0	0	0

```
A0:B0:C0              4          0              0
A0:B0:C1              0          0              0
A0:B1:C0              0          0              0
A0:B1:C1              0          0              0
A1:B0:C0              0          0              0
A1:B0:C1              0          0              0
A1:B1:C0              0          0              0
A1:B1:C1              0          0              0
rep1:A0:B0:C0         3          0              0
rep1:A0:B0:C1         0          0              0
rep1:A0:B1:C0         0          0              0
rep1:A0:B1:C1         0          0              0
rep1:A1:B0:C0         0          0              0
rep1:A1:B0:C1         0          0              0
rep1:A1:B1:C0         0          0              0
rep1:A1:B1:C1         0          0              0
rep2:A0:B0:C0         0          0              0
rep2:A0:B0:C1         0          0              0
rep2:A0:B1:C0         0          0              0
rep2:A0:B1:C1         0          0              0
rep2:A1:B0:C0         0          0              0
rep2:A1:B0:C1         0          0              0
rep2:A1:B1:C0         0          0              0
rep2:A1:B1:C1         0          0              0
```

9.6 Chapter 9

9.6.1 p343

(139) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)     40.50         0     2.3848  6 16.9822 2.666e-06 ***
rep1           -22.75         0     3.0788  6 -7.3892 0.0003153 ***
rep2           -17.75         0     3.0788  6 -5.7652 0.0011880 **
rep3             0.00         0     0.0000  6
rep1:block1      1.25         0     3.0788  6  0.4060 0.6988260
rep1:block2      4.50         0     3.3727  6  1.3342 0.2305270
rep1:block3      3.25         0     3.0788  6  1.0556 0.3317912
rep1:block4      0.00         0     0.0000  6
rep1:block5                   0
rep1:block6                   0
rep1:block7                   0
rep1:block8                   0
```

```
rep1:block9                  0
rep1:block10                 0
rep1:block11                 0
rep1:block12                 0
rep2:block1                  0
rep2:block2                  0
rep2:block3                  0
rep2:block4                  0
rep2:block5      9.00        0     3.0788  6  2.9232 0.0265209 *
rep2:block6      7.50        0     3.3727  6  2.2237 0.0678471 .
rep2:block7      4.50        0     3.0788  6  1.4616 0.1941629
rep2:block8      0.00        0     0.0000  6
rep2:block9                  0
rep2:block10                 0
rep2:block11                 0
rep2:block12                 0
rep3:block1                  0
rep3:block2                  0
rep3:block3                  0
rep3:block4                  0
rep3:block5                  0
rep3:block6                  0
rep3:block7                  0
rep3:block8                  0
rep3:block9      0.50        0     3.0788  6  0.1624 0.8763224
rep3:block10    -5.00        0     3.3727  6 -1.4825 0.1887247
rep3:block11     0.50        0     3.0788  6  0.1624 0.8763224
rep3:block12     0.00        0     0.0000  6
A0              -9.25        0     2.3848  6 -3.8787 0.0081834 **
A1               0.00        0     0.0000  6
B0              -3.75        0     2.3848  6 -1.5724 0.1669121
B1               0.00        0     0.0000  6
A0:B0            3.50        0     2.7538  6  1.2710 0.2507870
A0:B1            0.00        0     0.0000  6
A1:B0            0.00        0     0.0000  6
A1:B1            0.00        0     0.0000  6
C0              -7.25        0     2.3848  6 -3.0400 0.0228021 *
C1               0.00        0     0.0000  6
A0:C0            9.00        0     2.7538  6  3.2682 0.0170720 *
A0:C1            0.00        0     0.0000  6
A1:C0            0.00        0     0.0000  6
A1:C1            0.00        0     0.0000  6
B0:C0           -2.00        0     2.7538  6 -0.7263 0.4950160
B0:C1            0.00        0     0.0000  6
B1:C0            0.00        0     0.0000  6
B1:C1            0.00        0     0.0000  6
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.6.2 p348

(140) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)     40.50         0     2.3848  6 16.9822 2.666e-06 ***
rep1           -22.75         0     3.0788  6 -7.3892 0.0003153 ***
rep2           -17.75         0     3.0788  6 -5.7652 0.0011880 **
rep3             0.00         0     0.0000  6
A0              -8.75         0     3.3727  6 -2.5944 0.0409706 *
A1               0.00         0     0.0000  6
B0              -3.25         0     3.8944  6 -0.8345 0.4359464
B1               0.00         0     0.0000  6
A0:B0            2.50         0     6.7454  6  0.3706 0.7236497
A0:B1            0.00         0     0.0000  6
A1:B0            0.00         0     0.0000  6
A1:B1            0.00         0     0.0000  6
C0              -6.75         0     3.8944  6 -1.7332 0.1337546
C1               0.00         0     0.0000  6
A0:C0            8.00         0     6.7454  6  1.1860 0.2804551
A0:C1            0.00         0     0.0000  6
A1:C0            0.00         0     0.0000  6
A1:C1            0.00         0     0.0000  6
B0:C0           -3.00         0     6.7454  6 -0.4447 0.6720948
B0:C1            0.00         0     0.0000  6
B1:C0            0.00         0     0.0000  6
B1:C1            0.00         0     0.0000  6
A0:B0:C0         2.00         0    12.3153  6  0.1624 0.8763224
A0:B0:C1         0.00         0     0.0000  6
A0:B1:C0         0.00         0     0.0000  6
A0:B1:C1         0.00         0     0.0000  6
A1:B0:C0         0.00         0     0.0000  6
A1:B0:C1         0.00         0     0.0000  6
A1:B1:C0         0.00         0     0.0000  6
A1:B1:C1         0.00         0     0.0000  6
rep1:block1      0.75         0     4.3541  6  0.1723 0.8689036
rep1:block2      4.50         0     3.3727  6  1.3342 0.2305270
rep1:block3      2.75         0     4.3541  6  0.6316 0.5509461
rep1:block4      0.00         0     0.0000  6
rep1:block5                   0
rep1:block6                   0
rep1:block7                   0
```

```
rep1:block8                   0
rep1:block9                   0
rep1:block10                  0
rep1:block11                  0
rep1:block12                  0
rep2:block1                   0
rep2:block2                   0
rep2:block3                   0
rep2:block4                   0
rep2:block5      8.50         0     4.3541  6  1.9522 0.0987607 .
rep2:block6      7.50         0     3.3727  6  2.2237 0.0678471 .
rep2:block7      4.00         0     4.3541  6  0.9187 0.3936995
rep2:block8      0.00         0     0.0000  6
rep2:block9                   0
rep2:block10                  0
rep2:block11                  0
rep2:block12                  0
rep3:block1                   0
rep3:block2                   0
rep3:block3                   0
rep3:block4                   0
rep3:block5                   0
rep3:block6                   0
rep3:block7                   0
rep3:block8                   0
rep3:block9      0.00         0     3.3727  6  0.0000 1.0000000
rep3:block10    -5.00         0     3.3727  6 -1.4825 0.1887247
rep3:block11     0.00         0     0.0000  6
rep3:block12     0.00         0     0.0000  6
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.6.3 p353

(141) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)   61.438         0     2.0416 10  30.0934 3.842e-11 ***
rep1         -32.875         0     2.1323 10 -15.4173 2.685e-08 ***
rep2           0.000         0     0.0000 10
rep1:block1   -3.125         0     2.1323 10  -1.4655 0.1735006
rep1:block2    5.250         0     2.4622 10   2.1322 0.0588002 .
rep1:block3    9.125         0     2.1323 10   4.2793 0.0016131 **
rep1:block4    0.000         0     0.0000 10
rep1:block5                  0
rep1:block6                  0
rep1:block7                  0
rep1:block8                  0
rep2:block1                  0
rep2:block2                  0
rep2:block3                  0
rep2:block4                  0
rep2:block5  -10.625         0     2.1323 10  -4.9828 0.0005512 ***
rep2:block6   -4.250         0     2.4622 10  -1.7261 0.1150383
rep2:block7    3.625         0     2.1323 10   1.7000 0.1199674
rep2:block8    0.000         0     0.0000 10
A0            -6.375         0     2.6116 10  -2.4411 0.0347860 *
A1             0.000         0     0.0000 10
B0            -3.750         0     2.6116 10  -1.4359 0.1815604
B1             0.000         0     0.0000 10
A0:B0         -0.250         0     3.4821 10  -0.0718 0.9441800
A0:B1          0.000         0     0.0000 10
A1:B0          0.000         0     0.0000 10
A1:B1          0.000         0     0.0000 10
C0           -10.250         0     2.6116 10  -3.9248 0.0028439 **
C1             0.000         0     0.0000 10
A0:C0          4.500         0     3.4821 10   1.2923 0.2253083
A0:C1          0.000         0     0.0000 10
```

A1:C0	0.000	0	0.0000	10			
A1:C1	0.000	0	0.0000	10			
B0:C0	8.500	0	3.0156	10	2.8187	0.0182015	*
B0:C1	0.000	0	0.0000	10			
B1:C0	0.000	0	0.0000	10			
B1:C1	0.000	0	0.0000	10			
A0:B0:C0	-3.000	0	3.4821	10	-0.8615	0.4091189	
A0:B0:C1	0.000	0	0.0000	10			
A0:B1:C0	0.000	0	0.0000	10			
A0:B1:C1	0.000	0	0.0000	10			
A1:B0:C0	0.000	0	0.0000	10			
A1:B0:C1	0.000	0	0.0000	10			
A1:B1:C0	0.000	0	0.0000	10			
A1:B1:C1	0.000	0	0.0000	10			
D0	-4.625	0	2.6116	10	-1.7710	0.1069851	
D1	0.000	0	0.0000	10			
A0:D0	2.500	0	3.0156	10	0.8290	0.4264346	
A0:D1	0.000	0	0.0000	10			
A1:D0	0.000	0	0.0000	10			
A1:D1	0.000	0	0.0000	10			
B0:D0	3.250	0	3.4821	10	0.9333	0.3726292	
B0:D1	0.000	0	0.0000	10			
B1:D0	0.000	0	0.0000	10			
B1:D1	0.000	0	0.0000	10			
A0:B0:D0	1.000	0	3.4821	10	0.2872	0.7798349	
A0:B0:D1	0.000	0	0.0000	10			
A0:B1:D0	0.000	0	0.0000	10			
A0:B1:D1	0.000	0	0.0000	10			
A1:B0:D0	0.000	0	0.0000	10			
A1:B0:D1	0.000	0	0.0000	10			
A1:B1:D0	0.000	0	0.0000	10			
A1:B1:D1	0.000	0	0.0000	10			
C0:D0	9.500	0	3.4821	10	2.7282	0.0212575	*
C0:D1	0.000	0	0.0000	10			
C1:D0	0.000	0	0.0000	10			
C1:D1	0.000	0	0.0000	10			
A0:C0:D0	-4.500	0	3.4821	10	-1.2923	0.2253083	
A0:C0:D1	0.000	0	0.0000	10			
A0:C1:D0	0.000	0	0.0000	10			
A0:C1:D1	0.000	0	0.0000	10			
A1:C0:D0	0.000	0	0.0000	10			
A1:C0:D1	0.000	0	0.0000	10			
A1:C1:D0	0.000	0	0.0000	10			
A1:C1:D1	0.000	0	0.0000	10			
B0:C0:D0	-12.000	0	3.4821	10	-3.4462	0.0062660	**
B0:C0:D1	0.000	0	0.0000	10			
B0:C1:D0	0.000	0	0.0000	10			
B0:C1:D1	0.000	0	0.0000	10			

```
B1:C0:D0       0.000         0     0.0000 10
B1:C0:D1       0.000         0     0.0000 10
B1:C1:D0       0.000         0     0.0000 10
B1:C1:D1       0.000         0     0.0000 10
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.7 Chapter 10

9.7.1 p388

(142) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)   42.833         0    0.74536  6  57.4669 1.865e-09 ***
rep1         -12.667         0    0.74536  6 -16.9941 2.655e-06 ***
rep2           0.000         0    0.00000  6
A0           -16.167         0    1.05409  6 -15.3370 4.854e-06 ***
A1           -18.500         0    1.05409  6 -17.5506 2.196e-06 ***
A2             0.000         0    0.00000  6
B0           -10.167         0    1.05409  6  -9.6449 7.115e-05 ***
B1           -13.500         0    1.05409  6 -12.8072 1.392e-05 ***
B2             0.000         0    0.00000  6
A0:B0          3.833         0    1.58114  6   2.4244 0.0515527 .
A0:B1         18.667         0    1.58114  6  11.8058 2.232e-05 ***
A0:B2          0.000         0    0.00000  6
A1:B0         26.167         0    1.58114  6  16.5493 3.104e-06 ***
A1:B1         18.833         0    1.58114  6  11.9112 2.120e-05 ***
A1:B2          0.000         0    0.00000  6
A2:B0          0.000         0    0.00000  6
A2:B1          0.000         0    0.00000  6
A2:B2          0.000         0    0.00000  6
rep1:block1    3.000         0    1.05409  6   2.8460 0.0293332 *
rep1:block2    6.333         0    1.05409  6   6.0083 0.0009575 ***
rep1:block3    0.000         0    0.00000  6
rep1:block4                  0
rep1:block5                  0
rep1:block6                  0
rep2:block1                  0
rep2:block2                  0
rep2:block3                  0
rep2:block4    0.000         0    0.00000  6
rep2:block5    0.000         0    0.00000  6
rep2:block6    0.000         0    0.00000  6
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.8 Chapter 14

9.8.1 p570

(143) 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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)   9.3333         0             0
A0           -1.3333         0             0
A1           -1.0000         0             0
A2            0.0000         0             0
B0           -0.3333         0             0
B1            1.0000         0             0
B2            0.0000         0             0
C0           -0.3333         0             0
C1           -1.0000         0             0
C2            0.0000         0             0
D0           -2.3333         0             0
D1           -3.0000         0             0
D2            0.0000         0             0
A0:B0         0.0000         0             0
A0:B1         0.0000         0             0
A0:B2         0.0000         0             0
A1:B0         0.0000         0             0
A1:B1         0.0000         0             0
A1:B2         0.0000         0             0
A2:B0         0.0000         0             0
A2:B1         0.0000         0             0
A2:B2         0.0000         0             0
A0:C0         0.0000         0             0
A0:C1         0.0000         0             0
A0:C2         0.0000         0             0
A1:C0         0.0000         0             0
A1:C1         0.0000         0             0
A1:C2         0.0000         0             0
A2:C0         0.0000         0             0
A2:C1         0.0000         0             0
A2:C2         0.0000         0             0
A0:D0         0.0000         0             0
A0:D1         0.0000         0             0
A0:D2         0.0000         0             0
A1:D0         0.0000         0             0
A1:D1         0.0000         0             0
A1:D2         0.0000         0             0
A2:D0         0.0000         0             0
A2:D1         0.0000         0             0
A2:D2         0.0000         0             0
B0:C0         0.0000         0             0
B0:C1         0.0000         0             0
```

```
B0:C2          0.0000          0              0
B1:C0          0.0000          0              0
B1:C1          0.0000          0              0
B1:C2          0.0000          0              0
B2:C0          0.0000          0              0
B2:C1          0.0000          0              0
B2:C2          0.0000          0              0
B0:D0          0.0000          0              0
B0:D1          0.0000          0              0
B0:D2          0.0000          0              0
B1:D0          0.0000          0              0
B1:D1          0.0000          0              0
B1:D2          0.0000          0              0
B2:D0          0.0000          0              0
B2:D1          0.0000          0              0
B2:D2          0.0000          0              0
C0:D0          0.0000          0              0
C0:D1          0.0000          0              0
C0:D2          0.0000          0              0
C1:D0          0.0000          0              0
C1:D1          0.0000          0              0
C1:D2          0.0000          0              0
C2:D0          0.0000          0              0
C2:D1          0.0000          0              0
C2:D2          0.0000          0              0
```

9.8.2 p578

(144) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)  21.0000         0             0
A0            1.0000         0             0
A1            0.0000         0             0
B0            3.0000         0             0
B1            0.0000         0             0
C0            2.0000         0             0
C1            0.0000         0             0
D0            2.3333         0             0
D1            0.0000         0             0
E0            7.6667         0             0
E1            0.0000         0             0
F0            6.6667         0             0
```

```
F1            0.0000         0             0
G0            0.6667         0             0
G1            0.0000         0             0
H0           -2.6667         0             0
H1            0.0000         0             0
J0           -6.0000         0             0
J1            0.0000         0             0
K0           -0.6667         0             0
K1            0.0000         0             0
L0           -5.0000         0             0
L1            0.0000         0             0
```

(145) 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 Estimable Std. Error Df  t value Pr(>|t|)
(Intercept)     26.5         0     1.1180  1  23.7023  0.02684 *
E0               6.0         0     1.1547  1   5.1962  0.12104
E1               0.0         0     0.0000  1
F0               1.5         0     1.0408  1   1.4412  0.38618
F1               0.0         0     0.0000  1
E0:F0           -4.5         0     1.0408  1  -4.3235  0.14470
E0:F1            0.0         0     0.0000  1
E1:F0            0.0         0     0.0000  1
E1:F1            0.0         0     0.0000  1
J0             -11.5         0     1.0408  1 -11.0488  0.05746 .
J1               0.0         0     0.0000  1
E0:J0            0.5         0     1.0408  1   0.4804  0.71490
E0:J1            0.0         0     0.0000  1
E1:J0            0.0         0     0.0000  1
E1:J1            0.0         0     0.0000  1
F0:J0           12.5         0     1.0408  1  12.0096  0.05289 .
F0:J1            0.0         0     0.0000  1
F1:J0            0.0         0     0.0000  1
F1:J1            0.0         0     0.0000  1
L0              -3.5         0     1.0408  1  -3.3627  0.18402
L1               0.0         0     0.0000  1
E0:L0            3.5         0     1.0408  1   3.3627  0.18402
E0:L1            0.0         0     0.0000  1
E1:L0            0.0         0     0.0000  1
E1:L1            0.0         0     0.0000  1
```

```
F0:L0            0.5         0     1.0408  1   0.4804  0.71490
F0:L1            0.0         0     0.0000  1
F1:L0            0.0         0     0.0000  1
F1:L1            0.0         0     0.0000  1
J0:L0           -1.5         0     1.0408  1  -1.4412  0.38618
J0:L1            0.0         0     0.0000  1
J1:L0            0.0         0     0.0000  1
J1:L1            0.0         0     0.0000  1
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.9 Chapter 16

9.9.1 p619

(146) MODEL

```r
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
```

```
$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     Inf < 2.2e-16 ***
B    1  1.6667  1.6667     Inf < 2.2e-16 ***
C    1 10.0000 10.0000     Inf < 2.2e-16 ***
A:B  1  6.0000  6.0000     Inf < 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)
A    1   19.6    19.6     Inf < 2.2e-16 ***
B    1    3.6     3.6     Inf < 2.2e-16 ***
C    1   13.5    13.5     Inf < 2.2e-16 ***
A:B  1    6.0     6.0     Inf < 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)
A    1   24.0    24.0     Inf < 2.2e-16 ***
```

```
B    1    6.0     6.0     Inf < 2.2e-16 ***
C    1   13.5    13.5     Inf < 2.2e-16 ***
A:B  1    6.0     6.0     Inf < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)     13.5         0          0  2     Inf < 2.2e-16 ***
A0              -6.0         0          0  2    -Inf < 2.2e-16 ***
A1               0.0         0          0  2
B0               0.0         0          0  2    -Inf < 2.2e-16 ***
B1               0.0         0          0  2
C0              -3.0         0          0  2    -Inf < 2.2e-16 ***
C1               0.0         0          0  2
A0:B0            4.0         0          0  2     Inf < 2.2e-16 ***
A0:B1            0.0         0          0  2
A1:B0            0.0         0          0  2
A1:B1            0.0         0          0  2
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(147) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)  12.8333         0     1.3333  2  9.6250  0.01062 *
A0           -4.0000         0     1.6330  2 -2.4495  0.13397
A1            0.0000         0     0.0000  2
B0            1.3333         0     1.3333  2  1.0000  0.42265
B1            0.0000         0     0.0000  2
C0           -3.0000         0     1.6330  2 -1.8371  0.20759
C1            0.0000         0     0.0000  2
A0:C0         1.3333         0     2.6667  2  0.5000  0.66667
A0:C1         0.0000         0     0.0000  2
A1:C0         0.0000         0     0.0000  2
A1:C1         0.0000         0     0.0000  2
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(148) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)  12.1667         0     1.3333  2  9.1250   0.0118 *
A0           -3.3333         0     1.3333  2 -2.5000   0.1296
A1            0.0000         0     0.0000  2
B0            2.0000         0     1.6330  2  1.2247   0.3453
B1            0.0000         0     0.0000  2
C0           -1.6667         0     2.1082  2 -0.7906   0.5120
C1            0.0000         0     0.0000  2
B0:C0        -1.3333         0     2.6667  2 -0.5000   0.6667
B0:C1         0.0000         0     0.0000  2
B1:C0         0.0000         0     0.0000  2
B1:C1         0.0000         0     0.0000  2
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.9.2 p626

(149) 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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)  13.7877         0    0.56467  2 24.4174 0.001673 **
A0           -6.3427         0    0.89281  2 -7.1041 0.019244 *
A1            0.0000         0    0.00000  2
B0            0.9125         0    0.69157  2  1.3195 0.317812
B1            0.0000         0    0.00000  2
C0           -3.6073         0    0.56467  2 -6.3884 0.023637 *
C1            0.0000         0    0.00000  2
A0:B0         3.7717         0    1.12933  2  3.3397 0.079156 .
A0:B1         0.0000         0    0.00000  2
A1:B0         0.0000         0    0.00000  2
A1:B1         0.0000         0    0.00000  2
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(150) 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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)  13.4865         0     1.1284  2 11.9516 0.006928 **
A0           -4.9480         0     1.3820  2 -3.5802 0.069930 .
A1            0.0000         0     0.0000  2
B0            2.0060         0     1.1284  2  1.7777 0.217428
B1            0.0000         0     0.0000  2
C0           -4.0985         0     1.3820  2 -2.9656 0.097381 .
C1            0.0000         0     0.0000  2
A0:C0         2.5670         0     2.2569  2  1.1374 0.373273
A0:C1         0.0000         0     0.0000  2
A1:C0         0.0000         0     0.0000  2
A1:C1         0.0000         0     0.0000  2
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(151) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)  12.5333         0     1.3795  2  9.0853   0.0119 *
A0           -3.8297         0     1.3795  2 -2.7761   0.1090
A1            0.0000         0     0.0000  2
B0            2.7940         0     1.6896  2  1.6537   0.2400
B1            0.0000         0     0.0000  2
C0           -2.3573         0     2.1812  2 -1.0807   0.3928
C1            0.0000         0     0.0000  2
B0:C0        -1.2457         0     2.7590  2 -0.4515   0.6959
B0:C1         0.0000         0     0.0000  2
B1:C0         0.0000         0     0.0000  2
B1:C1         0.0000         0     0.0000  2
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.10 Chapter 17

9.10.1 p642

(152) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   2.2750         0    0.48520 24  4.6888 9.162e-05 ***
A0           -0.8500         0    0.34309 24 -2.4775   0.02066 *
A1            0.0000         0    0.00000 24
B0            0.1500         0    0.34309 24  0.4372   0.66587
B1            0.0000         0    0.00000 24
C0           -0.1250         0    0.34309 24 -0.3643   0.71879
C1            0.0000         0    0.00000 24
D0            0.5625         0    0.34309 24  1.6395   0.11415
D1            0.0000         0    0.00000 24
```

```
E0           -0.2875         0    0.34309 24 -0.8380   0.41031
E1            0.0000         0    0.00000 24
F0            0.0375         0    0.34309 24  0.1093   0.91387
F1            0.0000         0    0.00000 24
G0            0.4625         0    0.34309 24  1.3481   0.19023
G1            0.0000         0    0.00000 24
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(153) MODEL

```r
GLM(log(S) ~ A + B + C + D + E + F + G, v2p642) # OK
```

```
$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     Inf < 2.2e-16 ***
B  1   0.600   0.600     Inf < 2.2e-16 ***
C  1   0.284   0.284     Inf < 2.2e-16 ***
D  1   0.384   0.384     Inf < 2.2e-16 ***
E  1   0.741   0.741     Inf < 2.2e-16 ***
F  1 261.783 261.783     Inf < 2.2e-16 ***
G  1   1.127   1.127     Inf < 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)
A  1   1.511   1.511     Inf < 2.2e-16 ***
B  1   0.600   0.600     Inf < 2.2e-16 ***
C  1   0.284   0.284     Inf < 2.2e-16 ***
D  1   0.384   0.384     Inf < 2.2e-16 ***
E  1   0.741   0.741     Inf < 2.2e-16 ***
F  1 261.783 261.783     Inf < 2.2e-16 ***
G  1   1.127   1.127     Inf < 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)
A  1   1.511   1.511     Inf < 2.2e-16 ***
B  1   0.600   0.600     Inf < 2.2e-16 ***
C  1   0.284   0.284     Inf < 2.2e-16 ***
```

```
D  1   0.384   0.384     Inf < 2.2e-16 ***
E  1   0.741   0.741     Inf < 2.2e-16 ***
F  1 261.783 261.783     Inf < 2.2e-16 ***
G  1   1.127   1.127     Inf < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
            Estimate Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   0.2218         0          0 24     Inf < 2.2e-16 ***
A0            0.4346         0          0 24     Inf < 2.2e-16 ***
A1            0.0000         0          0 24
B0           -0.2740         0          0 24    -Inf < 2.2e-16 ***
B1            0.0000         0          0 24
C0            0.1885         0          0 24     Inf < 2.2e-16 ***
C1            0.0000         0          0 24
D0           -0.2190         0          0 24    -Inf < 2.2e-16 ***
D1            0.0000         0          0 24
E0            0.3044         0          0 24     Inf < 2.2e-16 ***
E1            0.0000         0          0 24
F0           -5.7204         0          0 24    -Inf < 2.2e-16 ***
F1            0.0000         0          0 24
G0            0.3754         0          0 24     Inf < 2.2e-16 ***
G1            0.0000         0          0 24
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.11 Chapter 19

9.11.1 p700

(154) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   14.675         0    0.76085  3 19.2875 0.0003044 ***
P1             4.670         0    0.66413  3  7.0318 0.0059092 **
P2            -0.600         0    0.52504  3 -1.1428 0.3360714
P3             0.450         0    0.52504  3  0.8571 0.4544117
P4             0.000         0    0.00000  3
S1             2.860         0    0.55067  3  5.1937 0.0138648 *
S2             3.595         0    0.55067  3  6.5285 0.0073033 **
S3            -3.455         0    0.55067  3 -6.2742 0.0081740 **
S4             0.000         0    0.00000  3
T1             5.650         0    0.55067  3 10.2603 0.0019739 **
T2             6.255         0    0.55067  3 11.3590 0.0014638 **
T3            -1.285         0    0.55067  3 -2.3335 0.1018191
T4             0.000         0    0.00000  3
C0             0.000         0    0.00000  3
C1             2.800         0    0.66413  3  4.2161 0.0243844 *
C2             0.620         0    0.66413  3  0.9336 0.4193997
C3            -1.140         0    0.66413  3 -1.7165 0.1845672
C4             0.000         0    0.00000  3
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

9.11.2 p703

(155) 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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)  14.2042         0    1.02435  6 13.8665 8.759e-06 ***
P1            4.8875         0    0.96740  6  5.0522 0.0023285 **
```

```
P2          -0.7000         0    0.82500  6 -0.8485 0.4287138
P3           0.3500         0    0.82500  6  0.4242 0.6861791
P4          -0.1000         0    0.82500  6 -0.1212 0.9074805
P5           0.0000         0    0.00000  6
S1           3.4500         0    0.75312  6  4.5810 0.0037667 **
S2           3.4250         0    0.75312  6  4.5478 0.0039011 **
S3          -3.7083         0    0.75312  6 -4.9240 0.0026462 **
S4           0.0000         0    0.00000  6
T1           5.5667         0    0.75312  6  7.3915 0.0003148 ***
T2           6.4250         0    0.75312  6  8.5312 0.0001422 ***
T3          -0.5250         0    0.75312  6 -0.6971 0.5118309
T4           0.0000         0    0.00000  6
C1           2.6750         0    0.82500  6  3.2424 0.0176331 *
C2           0.8750         0    0.82500  6  1.0606 0.3296846
C3           0.0000         0    0.82500  6  0.0000 1.0000000
C4           0.0000         0    0.00000  6
---
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
```

```r
require(daewr)
```

10.1 Chapter 2

10.1.1 p22

(156) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
```

```
(Intercept)   8.3125         0    0.76547  9 10.8594 1.794e-06 ***
time35       -2.8750         0    1.08253  9 -2.6558   0.02623 *
time40       -0.0625         0    1.08253  9 -0.0577   0.95522
time45        0.0000         0    0.00000  9
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.1.2 p32

(157) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)  0.53776         0   0.016582  9 32.4307 1.239e-10 ***
time35       0.07182         0   0.023450  9  3.0626   0.01351 *
time40       0.00385         0   0.023450  9  0.1643   0.87315
time45       0.00000         0   0.000000  9
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.1.3 p42

(158) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)     48.7         0    0.65013 14  74.9085 < 2.2e-16 ***
treatA         -10.0         0    0.97519 14 -10.2544 6.837e-08 ***
treatB          -3.7         0    0.97519 14  -3.7941  0.001974 **
treatC           0.1         0    0.91942 14   0.1088  0.914933
treatD           0.0         0    0.00000 14
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.2 Chapter 3

10.2.1 p63

(159) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)        59.0         0     1.6073  9  36.7081 4.094e-11 ***
Eth0.1              8.0         0     2.2730  9   3.5195 0.0065202 **
Eth0.2              8.5         0     2.2730  9   3.7395 0.0046291 **
Eth0.3              0.0         0     0.0000  9
Ratio14            33.0         0     2.2730  9  14.5181 1.498e-07 ***
Ratio15            17.5         0     2.2730  9   7.6990 3.003e-05 ***
Ratio16             0.0         0     0.0000  9
Eth0.1:Ratio14    -36.0         0     3.2146  9 -11.1991 1.384e-06 ***
Eth0.1:Ratio15    -15.0         0     3.2146  9  -4.6663 0.0011747 **
Eth0.1:Ratio16      0.0         0     0.0000  9
```

```
Eth0.2:Ratio14    -21.0         0     3.2146  9  -6.5328 0.0001073 ***
Eth0.2:Ratio15     -4.5         0     3.2146  9  -1.3999 0.1950620
Eth0.2:Ratio16      0.0         0     0.0000  9
Eth0.3:Ratio14      0.0         0     0.0000  9
Eth0.3:Ratio15      0.0         0     0.0000  9
Eth0.3:Ratio16      0.0         0     0.0000  9
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(160) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)        59.0         0     1.6073  9  36.7081 4.094e-11 ***
```

```
Ratio14            33.0         0     2.2730  9  14.5181 1.498e-07 ***
Ratio15            17.5         0     2.2730  9   7.6990 3.003e-05 ***
Ratio16             0.0         0     0.0000  9
Eth0.1              8.0         0     2.2730  9   3.5195 0.0065202 **
Eth0.2              8.5         0     2.2730  9   3.7395 0.0046291 **
Eth0.3              0.0         0     0.0000  9
Ratio14:Eth0.1    -36.0         0     3.2146  9 -11.1991 1.384e-06 ***
Ratio14:Eth0.2    -21.0         0     3.2146  9  -6.5328 0.0001073 ***
Ratio14:Eth0.3      0.0         0     0.0000  9
Ratio15:Eth0.1    -15.0         0     3.2146  9  -4.6663 0.0011747 **
Ratio15:Eth0.2     -4.5         0     3.2146  9  -1.3999 0.1950620
Ratio15:Eth0.3      0.0         0     0.0000  9
Ratio16:Eth0.1      0.0         0     0.0000  9
Ratio16:Eth0.2      0.0         0     0.0000  9
Ratio16:Eth0.3      0.0         0     0.0000  9
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.2.2 p74

(161) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)        60.0         0     2.3585  8 25.4399 6.108e-09 ***
Eth0.1              7.0         0     2.8886  8  2.4234 0.0416315 *
Eth0.2              7.5         0     2.8886  8  2.5965 0.0317925 *
Eth0.3              0.0         0     0.0000  8
Ratio14            32.0         0     2.8886  8 11.0782 3.933e-06 ***
Ratio15            16.5         0     2.8886  8  5.7122 0.0004480 ***
Ratio16             0.0         0     0.0000  8
Eth0.1:Ratio14    -35.0         0     3.7291  8 -9.3856 1.360e-05 ***
Eth0.1:Ratio15    -14.0         0     3.7291  8 -3.7542 0.0055901 **
Eth0.1:Ratio16      0.0         0     0.0000  8
Eth0.2:Ratio14    -20.0         0     3.7291  8 -5.3632 0.0006751 ***
Eth0.2:Ratio15     -3.5         0     3.7291  8 -0.9386 0.3754235
Eth0.2:Ratio16      0.0         0     0.0000  8
Eth0.3:Ratio14      0.0         0     0.0000  8
Eth0.3:Ratio15      0.0         0     0.0000  8
Eth0.3:Ratio16      0.0         0     0.0000  8
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.2.3 p91

(162) MODEL

```r
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 Df  t value  Pr(>|t|)
(Intercept)   668.56     4.5178  8 147.9854 4.885e-15 ***
XA            -16.81     4.5178  8  -3.7214  0.005859 **
XB              0.94     4.5178  8   0.2075  0.840793
XC              5.44     4.5178  8   1.2036  0.263154
XA:XB          -6.69     4.5178  8  -1.4803  0.177071
XA:XC          12.56     4.5178  8   2.7807  0.023899 *
XB:XC           1.81     4.5178  8   0.4012  0.698780
XA:XB:XC       -5.81     4.5178  8  -1.2866  0.234218
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.2.4 p97

(163) 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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)           93         0             0
A-1                    4         0             0
A1                     0         0             0
B-1                  -45         0             0
B1                     0         0             0
A1:B1                -19         0             0
A1:B-1                 0         0             0
A-1:B1                 0         0             0
A-1:B-1                0         0             0
C-1                   -5         0             0
C1                     0         0             0
A1:C1                 -7         0             0
A1:C-1                 0         0             0
A-1:C1                 0         0             0
A-1:C-1                0         0             0
B1:C1                  0         0             0
B1:C-1                 0         0             0
B-1:C1                 0         0             0
B-1:C-1                0         0             0
A1:B1:C1               1         0             0
A1:B1:C-1              0         0             0
A1:B-1:C1              0         0             0
A1:B-1:C-1             0         0             0
A-1:B1:C1              0         0             0
A-1:B1:C-1             0         0             0
A-1:B-1:C1             0         0             0
A-1:B-1:C-1            0         0             0
```

D-1	-2	0	0
D1	0	0	0
A1:D1	0	0	0
A1:D-1	0	0	0
A-1:D1	0	0	0
A-1:D-1	0	0	0
B1:D1	3	0	0
B1:D-1	0	0	0
B-1:D1	0	0	0
B-1:D-1	0	0	0
A1:B1:D1	-3	0	0
A1:B1:D-1	0	0	0
A1:B-1:D1	0	0	0
A1:B-1:D-1	0	0	0
A-1:B1:D1	0	0	0
A-1:B1:D-1	0	0	0
A-1:B-1:D1	0	0	0
A-1:B-1:D-1	0	0	0
C1:D1	-12	0	0
C1:D-1	0	0	0
C-1:D1	0	0	0
C-1:D-1	0	0	0
A1:C1:D1	22	0	0
A1:C1:D-1	0	0	0
A1:C-1:D1	0	0	0
A1:C-1:D-1	0	0	0
A-1:C1:D1	0	0	0
A-1:C1:D-1	0	0	0
A-1:C-1:D1	0	0	0
A-1:C-1:D-1	0	0	0
B1:C1:D1	-1	0	0
B1:C1:D-1	0	0	0
B1:C-1:D1	0	0	0
B1:C-1:D-1	0	0	0
B-1:C1:D1	0	0	0
B-1:C1:D-1	0	0	0
B-1:C-1:D1	0	0	0
B-1:C-1:D-1	0	0	0
A1:B1:C1:D1	-5	0	0
A1:B1:C1:D-1	0	0	0
A1:B1:C-1:D1	0	0	0
A1:B1:C-1:D-1	0	0	0
A1:B-1:C1:D1	0	0	0
A1:B-1:C1:D-1	0	0	0
A1:B-1:C-1:D1	0	0	0
A1:B-1:C-1:D-1	0	0	0
A-1:B1:C1:D1	0	0	0
A-1:B1:C1:D-1	0	0	0

```
A-1:B1:C-1:D1          0         0             0
A-1:B1:C-1:D-1         0         0             0
A-1:B-1:C1:D1          0         0             0
A-1:B-1:C1:D-1         0         0             0
A-1:B-1:C-1:D1         0         0             0
A-1:B-1:C-1:D-1        0         0             0
```

10.2.5 p104

(164) MODEL

```r
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 Df t value Pr(>|t|)
(Intercept)   48.245             0
A             -0.400             0
B             -2.110             0
A:B            0.455             0
C              1.855             0
A:C           -1.245             0
B:C           -0.400             0
A:B:C          0.600             0
D              0.505             0
A:D           -0.290             0
B:D           -0.590             0
A:B:D          0.360             0
C:D            0.745             0
A:C:D          0.200             0
B:C:D         -0.790             0
A:B:C:D        0.760             0
```

10.3 Chapter 4

10.3.1 p122

(165) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   1.0578         0   0.048349 36 21.8784 < 2.2e-16 ***
rat1         -0.4160         0   0.057788 36 -7.1987 1.804e-08 ***
rat2         -0.4300         0   0.057788 36 -7.4410 8.740e-09 ***
rat3         -0.4040         0   0.057788 36 -6.9911 3.373e-08 ***
rat4         -0.3000         0   0.057788 36 -5.1914 8.362e-06 ***
rat5         -0.1340         0   0.057788 36 -2.3188 0.0261960 *
rat6         -0.2880         0   0.057788 36 -4.9837 1.579e-05 ***
rat7         -0.2140         0   0.057788 36 -3.7032 0.0007098 ***
rat8          0.0240         0   0.057788 36  0.4153 0.6803798
```

```
rat9          0.0840         0   0.057788 36  1.4536 0.1547238
rat10         0.0000         0   0.000000 36
dose0        -0.0860         0   0.040862 36 -2.1046 0.0423697 *
dose0.5       0.0840         0   0.040862 36  2.0557 0.0471211 *
dose1         0.1640         0   0.040862 36  4.0135 0.0002899 ***
dose1.5       0.1590         0   0.040862 36  3.8911 0.0004137 ***
dose2         0.0000         0   0.000000 36
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.3.2 p127

(166) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)                 13.875         0     1.2073  7 11.4922 8.495e-06 ***
block1                       3.450         0     0.8049  7  4.2863  0.003627 **
block2                       0.000         0     0.0000  7
treatcontrol               -15.200         0     1.6098  7 -9.4422 3.119e-05 ***
treattreated                 0.000         0     0.0000  7
strain129Ola                 0.550         0     1.6098  7  0.3417  0.742635
strainA/J                    2.100         0     1.6098  7  1.3045  0.233308
strainBALB/c                 7.450         0     1.6098  7  4.6279  0.002404 **
strainNIH                    0.000         0     0.0000  7
treatcontrol:strainA/J       4.550         0     2.2766  7  1.9986  0.085796 .
treatcontrol:strainNIH       8.550         0     2.2766  7  3.7556  0.007116 **
treatcontrol:strain129Ola    6.600         0     2.2766  7  2.8991  0.023016 *
treatcontrol:strainBALB/c    0.000         0     0.0000  7
treattreated:strainA/J       0.000         0     0.0000  7
treattreated:strainNIH       0.000         0     0.0000  7
treattreated:strain129Ola    0.000         0     0.0000  7
treattreated:strainBALB/c    0.000         0     0.0000  7
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.3.3 p129

(167) MODEL

```r
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 Estimable Std. Error  Df  t value  Pr(>|t|)
(Intercept)  240.440         0     2.5243 124  95.2517 < 2.2e-16 ***
id1          -92.907         0     3.2290 124 -28.7722 < 2.2e-16 ***
id2          -57.860         0     3.2290 124 -17.9186 < 2.2e-16 ***
id3          -92.907         0     3.2290 124 -28.7722 < 2.2e-16 ***
id4          -60.360         0     3.2290 124 -18.6928 < 2.2e-16 ***
id5          -22.267         0     3.2290 124  -6.8957 2.422e-10 ***
id6          -92.860         0     3.2290 124 -28.7577 < 2.2e-16 ***
id7          -66.720         0     3.2290 124 -20.6625 < 2.2e-16 ***
id8          -59.540         0     3.2290 124 -18.4389 < 2.2e-16 ***
id9            0.000         0     0.0000 124
teehgt1       -8.380         0     1.8643 124  -4.4950 1.575e-05 ***
teehgt2       -2.000         0     1.8643 124  -1.0728    0.2854
teehgt3        0.000         0     0.0000 124
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.3.4 p136

(168) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)  1352.56         0     414.67  2  3.2618  0.08252 .
Subject1     -276.00         0     383.91  2 -0.7189  0.54684
Subject2     -138.33         0     383.91  2 -0.3603  0.75310
Subject3        0.00         0       0.00  2
Period1      -171.00         0     383.91  2 -0.4454  0.69959
Period2      -111.33         0     383.91  2 -0.2900  0.79912
Period3         0.00         0       0.00  2
TreatA         78.33         0     383.91  2  0.2040  0.85720
TreatB        -14.67         0     383.91  2 -0.0382  0.97300
TreatC          0.00         0       0.00  2
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.4 Chapter 5

10.4.1 p152

(169) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)  1.16425         0  0.0095535 26 121.8661 < 2.2e-16 ***
labA         0.02661         0  0.0139849 26   1.9026   0.06823 .
labB        -0.00237         0  0.0135107 26  -0.1758   0.86182
labC        -0.12111         0  0.0139849 26  -8.6598 3.878e-09 ***
labD         0.00000         0  0.0000000 26
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.4.2 p181

(170) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)         0.3410         0   0.014934  8 22.8334 1.435e-08 ***
formA               0.0225         0   0.021120  8  1.0653   0.31782
formB               0.0000         0   0.000000  8
tech1              -0.0470         0   0.021120  8 -2.2254   0.05671 .
tech2               0.0000         0   0.000000  8
formA:tech1        -0.0390         0   0.029868  8 -1.3057   0.22794
formA:tech2         0.0000         0   0.000000  8
formB:tech1         0.0000         0   0.000000  8
formB:tech2         0.0000         0   0.000000  8
formA:tech1:plot1  -0.0330         0   0.021120  8 -1.5625   0.15680
formA:tech1:plot2   0.0000         0   0.000000  8
formA:tech2:plot1   0.0215         0   0.021120  8  1.0180   0.33848
formA:tech2:plot2   0.0000         0   0.000000  8
formB:tech1:plot1  -0.0235         0   0.021120  8 -1.1127   0.29816
formB:tech1:plot2   0.0000         0   0.000000  8
formB:tech2:plot1   0.0155         0   0.021120  8  0.7339   0.48396
formB:tech2:plot2   0.0000         0   0.000000  8
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.5 Chapter 7

10.5.1 p260

(171) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)   4.5000         0    0.69096  9  6.5126 0.0001098 ***
recipeA       0.6250         0    0.61802  9  1.0113 0.3382874
recipeB       1.3750         0    0.61802  9  2.2249 0.0531409 .
recipeC       2.0000         0    0.61802  9  3.2362 0.0102213 *
recipeD       0.0000         0    0.00000  9
panelist1    -0.5000         0    0.97717  9 -0.5117 0.6211912
panelist2     0.6875         0    0.92702  9  0.7416 0.4772232
panelist3    -0.3125         0    0.92702  9 -0.3371 0.7437697
panelist4     0.3125         0    0.92702  9  0.3371 0.7437697
panelist5    -0.1875         0    0.92702  9 -0.2023 0.8442116
panelist6     1.5000         0    0.87401  9  1.7162 0.1202534
panelist7     1.0000         0    0.97717  9  1.0234 0.3328547
panelist8     0.6875         0    0.92702  9  0.7416 0.4772232
panelist9    -0.3125         0    0.92702  9 -0.3371 0.7437697
panelist10    0.8125         0    0.92702  9  0.8765 0.4035670
panelist11    0.3125         0    0.92702  9  0.3371 0.7437697
panelist12    0.0000         0    0.00000  9
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.5.2 p262

(172) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)    78.00         0     2.6101  3 29.8842 8.23e-05 ***
Block1          6.25         0     3.6912  3  1.6932  0.18899
Block2          2.75         0     3.6912  3  0.7450  0.51032
Block3          9.50         0     3.6912  3  2.5737  0.08223 .
Block4          3.50         0     3.6912  3  0.9482  0.41298
Block5          2.00         0     3.0139  3  0.6636  0.55439
Block6          0.00         0     0.0000  3
TreatmentA     -6.50         0     3.0139  3 -2.1567  0.11995
TreatmentB    -13.00         0     3.0139  3 -4.3134  0.02295 *
TreatmentC     -6.00         0     3.0139  3 -1.9908  0.14057
TreatmentP      0.00         0     0.0000  3
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.5.3 p276

(173) MODEL

```r
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)  10.2000         0             0
Blocks1      -3.0350         0             0
Blocks2       0.0900         0             0
Blocks3      -0.9600         0             0
Blocks4      -2.1700         0             0
Blocks5      -0.4600         0             0
Blocks6      -2.5200         0             0
Blocks7      -3.8200         0             0
Blocks8       0.0000         0             0
A-1          -2.3388         0             0
A1            0.0000         0             0
B-1           1.4437         0             0
B1            0.0000         0             0
C-1          -1.2463         0             0
C1            0.0000         0             0
D-1           1.7937         0             0
D1            0.0000         0             0
E-1          -0.1563         0             0
E1            0.0000         0             0
F-1           0.5612         0             0
F1            0.0000         0             0
G-1          -4.2388         0             0
G1            0.0000         0             0
H-1          -1.1488         0             0
H1            0.0000         0             0
```

10.6 Chapter 8

10.6.1 p315

(174) 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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)      2.00875         0   0.040497 12 49.6029 3.109e-15 ***
Block1           0.02750         0   0.010921 12  2.5181  0.027005 *
Block2           0.00000         0   0.000000 12
A-1              0.03500         0   0.017268 12  2.0269  0.065486 .
A1               0.00000         0   0.000000 12
B-1              0.01250         0   0.017268 12  0.7239  0.483007
B1               0.00000         0   0.000000 12
A1:B1           -0.00625         0   0.024420 12 -0.2559  0.802336
A1:B-1           0.00000         0   0.000000 12
A-1:B1           0.00000         0   0.000000 12
A-1:B-1          0.00000         0   0.000000 12
Block1:A1:B1    -0.05250         0   0.015445 12 -3.3992  0.005277 **
Block1:A1:B-1   -0.03000         0   0.015445 12 -1.9424  0.075926 .
Block1:A-1:B1    0.01500         0   0.015445 12  0.9712  0.350618
Block1:A-1:B-1   0.00000         0   0.000000 12
Block2:A1:B1     0.00000         0   0.000000 12
Block2:A1:B-1    0.00000         0   0.000000 12
Block2:A-1:B1    0.00000         0   0.000000 12
Block2:A-1:B-1   0.00000         0   0.000000 12
C-1              0.01500         0   0.015445 12  0.9712  0.350618
C1               0.00000         0   0.000000 12
D-1             -0.01000         0   0.015445 12 -0.6475  0.529522
D1               0.00000         0   0.000000 12
C1:D1            0.01500         0   0.021842 12  0.6867  0.505299
C1:D-1           0.00000         0   0.000000 12
C-1:D1           0.00000         0   0.000000 12
C-1:D-1          0.00000         0   0.000000 12
A1:C1           -0.03500         0   0.021842 12 -1.6024  0.135048
A1:C-1           0.00000         0   0.000000 12
A-1:C1           0.00000         0   0.000000 12
A-1:C-1          0.00000         0   0.000000 12
```

A1:D1	-0.04000	0	0.021842	12	-1.8313	0.091980	.
A1:D-1	0.00000	0	0.000000	12			
A-1:D1	0.00000	0	0.000000	12			
A-1:D-1	0.00000	0	0.000000	12			
B1:C1	-0.02000	0	0.021842	12	-0.9157	0.377880	
B1:C-1	0.00000	0	0.000000	12			
B-1:C1	0.00000	0	0.000000	12			
B-1:C-1	0.00000	0	0.000000	12			
B1:D1	-0.03000	0	0.021842	12	-1.3735	0.194718	
B1:D-1	0.00000	0	0.000000	12			
B-1:D1	0.00000	0	0.000000	12			
B-1:D-1	0.00000	0	0.000000	12			
A1:B1:C1	0.06000	0	0.030890	12	1.9424	0.075926	.
A1:B1:C-1	0.00000	0	0.000000	12			
A1:B-1:C1	0.00000	0	0.000000	12			
A1:B-1:C-1	0.00000	0	0.000000	12			
A-1:B1:C1	0.00000	0	0.000000	12			
A-1:B1:C-1	0.00000	0	0.000000	12			
A-1:B-1:C1	0.00000	0	0.000000	12			
A-1:B-1:C-1	0.00000	0	0.000000	12			
A1:B1:D1	0.04500	0	0.030890	12	1.4568	0.170835	
A1:B1:D-1	0.00000	0	0.000000	12			
A1:B-1:D1	0.00000	0	0.000000	12			
A1:B-1:D-1	0.00000	0	0.000000	12			
A-1:B1:D1	0.00000	0	0.000000	12			
A-1:B1:D-1	0.00000	0	0.000000	12			
A-1:B-1:D1	0.00000	0	0.000000	12			
A-1:B-1:D-1	0.00000	0	0.000000	12			
A1:C1:D1	0.00000	0	0.030890	12	0.0000	1.000000	
A1:C1:D-1	0.00000	0	0.000000	12			
A1:C-1:D1	0.00000	0	0.000000	12			
A1:C-1:D-1	0.00000	0	0.000000	12			
A-1:C1:D1	0.00000	0	0.000000	12			
A-1:C1:D-1	0.00000	0	0.000000	12			
A-1:C-1:D1	0.00000	0	0.000000	12			
A-1:C-1:D-1	0.00000	0	0.000000	12			
B1:C1:D1	0.00000	0	0.030890	12	0.0000	1.000000	
B1:C1:D-1	0.00000	0	0.000000	12			
B1:C-1:D1	0.00000	0	0.000000	12			
B1:C-1:D-1	0.00000	0	0.000000	12			
B-1:C1:D1	0.00000	0	0.000000	12			
B-1:C1:D-1	0.00000	0	0.000000	12			
B-1:C-1:D1	0.00000	0	0.000000	12			
B-1:C-1:D-1	0.00000	0	0.000000	12			
A1:B1:C1:D1	-0.01500	0	0.043684	12	-0.3434	0.737260	
A1:B1:C1:D-1	0.00000	0	0.000000	12			
A1:B1:C-1:D1	0.00000	0	0.000000	12			
A1:B1:C-1:D-1	0.00000	0	0.000000	12			

```
A1:B-1:C1:D1      0.00000          0   0.000000 12
A1:B-1:C1:D-1     0.00000          0   0.000000 12
A1:B-1:C-1:D1     0.00000          0   0.000000 12
A1:B-1:C-1:D-1    0.00000          0   0.000000 12
A-1:B1:C1:D1      0.00000          0   0.000000 12
A-1:B1:C1:D-1     0.00000          0   0.000000 12
A-1:B1:C-1:D1     0.00000          0   0.000000 12
A-1:B1:C-1:D-1    0.00000          0   0.000000 12
A-1:B-1:C1:D1     0.00000          0   0.000000 12
A-1:B-1:C1:D-1    0.00000          0   0.000000 12
A-1:B-1:C-1:D1    0.00000          0   0.000000 12
A-1:B-1:C-1:D-1   0.00000          0   0.000000 12
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.6.2 p320

(175) MODEL

```r
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
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 Estimable Std. Error Df t value Pr(>|t|)
(Intercept)        48.2         0             0
A-                -24.3         0             0
A+                  0.0         0             0
B-                 -5.0         0             0
B+                  0.0         0             0
A-:B-               4.8         0             0
A-:B+               0.0         0             0
A+:B-               0.0         0             0
A+:B+               0.0         0             0
C-                -10.4         0             0
C+                  0.0         0             0
A-:C-              19.5         0             0
A-:C+               0.0         0             0
```

A+:C-	0.0	0	0
A+:C+	0.0	0	0
B-:C-	23.4	0	0
B-:C+	0.0	0	0
B+:C-	0.0	0	0
B+:C+	0.0	0	0
A-:B-:C-	-38.1	0	0
A-:B-:C+	0.0	0	0
A-:B+:C-	0.0	0	0
A-:B+:C+	0.0	0	0
A+:B-:C-	0.0	0	0
A+:B-:C+	0.0	0	0
A+:B+:C-	0.0	0	0
A+:B+:C+	0.0	0	0
D-	-3.8	0	0
D+	0.0	0	0
A-:D-	34.5	0	0
A-:D+	0.0	0	0
A+:D-	0.0	0	0
A+:D+	0.0	0	0
B-:D-	5.4	0	0
B-:D+	0.0	0	0
B+:D-	0.0	0	0
B+:D+	0.0	0	0
A-:B-:D-	-16.3	0	0
A-:B-:D+	0.0	0	0
A-:B+:D-	0.0	0	0
A-:B+:D+	0.0	0	0
A+:B-:D-	0.0	0	0
A+:B-:D+	0.0	0	0
A+:B+:D-	0.0	0	0
A+:B+:D+	0.0	0	0
C-:D-	17.3	0	0
C-:D+	0.0	0	0
C+:D-	0.0	0	0
C+:D+	0.0	0	0
A-:C-:D-	-18.1	0	0
A-:C-:D+	0.0	0	0
A-:C+:D-	0.0	0	0
A-:C+:D+	0.0	0	0
A+:C-:D-	0.0	0	0
A+:C-:D+	0.0	0	0
A+:C+:D-	0.0	0	0
A+:C+:D+	0.0	0	0
B-:C-:D-	-36.9	0	0
B-:C-:D+	0.0	0	0
B-:C+:D-	0.0	0	0
B-:C+:D+	0.0	0	0

B+:C-:D-	0.0	0	0
B+:C-:D+	0.0	0	0
B+:C+:D-	0.0	0	0
B+:C+:D+	0.0	0	0
A-:B-:C-:D-	56.8	0	0
A-:B-:C-:D+	0.0	0	0
A-:B-:C+:D-	0.0	0	0
A-:B-:C+:D+	0.0	0	0
A-:B+:C-:D-	0.0	0	0
A-:B+:C-:D+	0.0	0	0
A-:B+:C+:D-	0.0	0	0
A-:B+:C+:D+	0.0	0	0
A+:B-:C-:D-	0.0	0	0
A+:B-:C-:D+	0.0	0	0
A+:B-:C+:D-	0.0	0	0
A+:B-:C+:D+	0.0	0	0
A+:B+:C-:D-	0.0	0	0
A+:B+:C-:D+	0.0	0	0
A+:B+:C+:D-	0.0	0	0
A+:B+:C+:D+	0.0	0	0
E-	1.3	0	0
E+	0.0	0	0
A-:E-	-13.9	0	0
A-:E+	0.0	0	0
A+:E-	0.0	0	0
A+:E+	0.0	0	0
B-:E-	3.0	0	0
B-:E+	0.0	0	0
B+:E-	0.0	0	0
B+:E+	0.0	0	0
A-:B-:E-	-0.8	0	0
A-:B-:E+	0.0	0	0
A-:B+:E-	0.0	0	0
A-:B+:E+	0.0	0	0
A+:B-:E-	0.0	0	0
A+:B-:E+	0.0	0	0
A+:B+:E-	0.0	0	0
A+:B+:E+	0.0	0	0
C-:E-	2.7	0	0
C-:E+	0.0	0	0
C+:E-	0.0	0	0
C+:E+	0.0	0	0
A-:C-:E-	2.5	0	0
A-:C-:E+	0.0	0	0
A-:C+:E-	0.0	0	0
A-:C+:E+	0.0	0	0
A+:C-:E-	0.0	0	0
A+:C-:E+	0.0	0	0

A+:C+:E-	0.0	0	0
A+:C+:E+	0.0	0	0
B-:C-:E-	-6.4	0	0
B-:C-:E+	0.0	0	0
B-:C+:E-	0.0	0	0
B-:C+:E+	0.0	0	0
B+:C-:E-	0.0	0	0
B+:C-:E+	0.0	0	0
B+:C+:E-	0.0	0	0
B+:C+:E+	0.0	0	0
A-:B-:C-:E-	-1.5	0	0
A-:B-:C-:E+	0.0	0	0
A-:B-:C+:E-	0.0	0	0
A-:B-:C+:E+	0.0	0	0
A-:B+:C-:E-	0.0	0	0
A-:B+:C-:E+	0.0	0	0
A-:B+:C+:E-	0.0	0	0
A-:B+:C+:E+	0.0	0	0
A+:B-:C-:E-	0.0	0	0
A+:B-:C-:E+	0.0	0	0
A+:B-:C+:E-	0.0	0	0
A+:B-:C+:E+	0.0	0	0
A+:B+:C-:E-	0.0	0	0
A+:B+:C-:E+	0.0	0	0
A+:B+:C+:E-	0.0	0	0
A+:B+:C+:E+	0.0	0	0
D-:E-	3.0	0	0
D-:E+	0.0	0	0
D+:E-	0.0	0	0
D+:E+	0.0	0	0
A-:D-:E-	2.2	0	0
A-:D-:E+	0.0	0	0
A-:D+:E-	0.0	0	0
A-:D+:E+	0.0	0	0
A+:D-:E-	0.0	0	0
A+:D-:E+	0.0	0	0
A+:D+:E-	0.0	0	0
A+:D+:E+	0.0	0	0
B-:D-:E-	-4.9	0	0
B-:D-:E+	0.0	0	0
B-:D+:E-	0.0	0	0
B-:D+:E+	0.0	0	0
B+:D-:E-	0.0	0	0
B+:D-:E+	0.0	0	0
B+:D+:E-	0.0	0	0
B+:D+:E+	0.0	0	0
A-:B-:D-:E-	4.2	0	0
A-:B-:D-:E+	0.0	0	0

A-:B-:D+:E-	0.0	0	0
A-:B-:D+:E+	0.0	0	0
A-:B+:D-:E-	0.0	0	0
A-:B+:D-:E+	0.0	0	0
A-:B+:D+:E-	0.0	0	0
A-:B+:D+:E+	0.0	0	0
A+:B-:D-:E-	0.0	0	0
A+:B-:D-:E+	0.0	0	0
A+:B-:D+:E-	0.0	0	0
A+:B-:D+:E+	0.0	0	0
A+:B+:D-:E-	0.0	0	0
A+:B+:D-:E+	0.0	0	0
A+:B+:D+:E-	0.0	0	0
A+:B+:D+:E+	0.0	0	0
C-:D-:E-	-4.8	0	0
C-:D-:E+	0.0	0	0
C-:D+:E-	0.0	0	0
C-:D+:E+	0.0	0	0
C+:D-:E-	0.0	0	0
C+:D-:E+	0.0	0	0
C+:D+:E-	0.0	0	0
C+:D+:E+	0.0	0	0
A-:C-:D-:E-	-0.1	0	0
A-:C-:D-:E+	0.0	0	0
A-:C-:D+:E-	0.0	0	0
A-:C-:D+:E+	0.0	0	0
A-:C+:D-:E-	0.0	0	0
A-:C+:D-:E+	0.0	0	0
A-:C+:D+:E-	0.0	0	0
A-:C+:D+:E+	0.0	0	0
A+:C-:D-:E-	0.0	0	0
A+:C-:D-:E+	0.0	0	0
A+:C-:D+:E-	0.0	0	0
A+:C-:D+:E+	0.0	0	0
A+:C+:D-:E-	0.0	0	0
A+:C+:D-:E+	0.0	0	0
A+:C+:D+:E-	0.0	0	0
A+:C+:D+:E+	0.0	0	0
B-:C-:D-:E-	9.1	0	0
B-:C-:D-:E+	0.0	0	0
B-:C-:D+:E-	0.0	0	0
B-:C-:D+:E+	0.0	0	0
B-:C+:D-:E-	0.0	0	0
B-:C+:D-:E+	0.0	0	0
B-:C+:D+:E-	0.0	0	0
B-:C+:D+:E+	0.0	0	0
B+:C-:D-:E-	0.0	0	0
B+:C-:D-:E+	0.0	0	0

```
B+:C-:D+:E-          0.0          0              0
B+:C-:D+:E+          0.0          0              0
B+:C+:D-:E-          0.0          0              0
B+:C+:D-:E+          0.0          0              0
B+:C+:D+:E-          0.0          0              0
B+:C+:D+:E+          0.0          0              0
A-:B-:C-:D-:E-      -4.0          0              0
A-:B-:C-:D-:E+       0.0          0              0
A-:B-:C-:D+:E-       0.0          0              0
A-:B-:C-:D+:E+       0.0          0              0
A-:B-:C+:D-:E-       0.0          0              0
A-:B-:C+:D-:E+       0.0          0              0
A-:B-:C+:D+:E-       0.0          0              0
A-:B-:C+:D+:E+       0.0          0              0
A-:B+:C-:D-:E-       0.0          0              0
A-:B+:C-:D-:E+       0.0          0              0
A-:B+:C-:D+:E-       0.0          0              0
A-:B+:C-:D+:E+       0.0          0              0
A-:B+:C+:D-:E-       0.0          0              0
A-:B+:C+:D-:E+       0.0          0              0
A-:B+:C+:D+:E-       0.0          0              0
A-:B+:C+:D+:E+       0.0          0              0
A+:B-:C-:D-:E-       0.0          0              0
A+:B-:C-:D-:E+       0.0          0              0
A+:B-:C-:D+:E-       0.0          0              0
A+:B-:C-:D+:E+       0.0          0              0
A+:B-:C+:D-:E-       0.0          0              0
A+:B-:C+:D-:E+       0.0          0              0
A+:B-:C+:D+:E-       0.0          0              0
A+:B-:C+:D+:E+       0.0          0              0
A+:B+:C-:D-:E-       0.0          0              0
A+:B+:C-:D-:E+       0.0          0              0
A+:B+:C-:D+:E-       0.0          0              0
A+:B+:C-:D+:E+       0.0          0              0
A+:B+:C+:D-:E-       0.0          0              0
A+:B+:C+:D-:E+       0.0          0              0
A+:B+:C+:D+:E-       0.0          0              0
A+:B+:C+:D+:E+       0.0          0              0
```

10.6.3 p335

(176) 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))
```

```r
REG(y ~ A*B*C + P + Q + A:P + A:Q + B:P + B:Q + C:P + C:Q, gear) # OK
```

```
            Estimate Std. Error Df t value Pr(>|t|)
(Intercept)  15.4062             0
A            -4.9062             0
B            -0.1562             0
A:B           0.5312             0
C             3.9688             0
A:C           2.9062             0
B:C           0.4062             0
A:B:C         0.5938             0
P            -2.3438             0
Q            -3.4062             0
A:P          -0.9062             0
A:Q          -0.3438             0
B:P           1.0938             0
B:Q           0.1562             0
C:P          -0.2812             0
C:Q           0.7812             0
```

10.7 Chapter 9

10.7.1 p349

(177) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)  11.9000         0    1.60208 15  7.4278 2.121e-06 ***
Subject1     -0.4500         0    2.13611 15 -0.2107   0.83598
Subject2     -1.5500         0    2.13611 15 -0.7256   0.47924
Subject3      2.7500         0    2.13611 15  1.2874   0.21747
Subject4      0.4500         0    2.13611 15  0.2107   0.83598
Subject5      2.8000         0    2.13611 15  1.3108   0.20964
Subject6      5.2500         0    2.13611 15  2.4577   0.02663 *
Subject7      1.4500         0    2.13611 15  0.6788   0.50760
Subject8      0.8500         0    2.13611 15  0.3979   0.69630
Subject9      2.3500         0    2.13611 15  1.1001   0.28862
Subject10     3.2000         0    2.13611 15  1.4981   0.15487
Subject11     1.1500         0    2.13611 15  0.5384   0.59823
Subject12     0.5000         0    2.13611 15  0.2341   0.81810
Subject13    -2.9500         0    2.13611 15 -1.3810   0.18750
Subject14     1.2500         0    2.13611 15  0.5852   0.56713
Subject15     1.3500         0    2.13611 15  0.6320   0.53691
Subject16     0.4500         0    2.13611 15  0.2107   0.83598
Subject17     0.0000         0    0.00000 15
Period1      -0.2944         0    0.73395 15 -0.4012   0.69395
Period2       0.0000         0    0.00000 15
TreatA        0.5944         0    0.73395 15  0.8099   0.43065
TreatB        0.0000         0    0.00000 15
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.7.2 p355

(178) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)         60.210         0    14.2178 68   4.2349 7.030e-05 ***
Group1             275.892         0    18.7922 68  14.6812 < 2.2e-16 ***
Group2               0.000         0     0.0000 68
Group1:Subject1                    0
Group1:Subject2   -227.030         0    18.7273 68 -12.1230 < 2.2e-16 ***
Group1:Subject3   -177.713         0    18.7273 68  -9.4896 4.441e-14 ***
Group1:Subject4                    0
Group1:Subject5                    0
Group1:Subject6    -40.340         0    18.7273 68  -2.1541 0.0347809 *
Group1:Subject7                    0
Group1:Subject8   -295.857         0    18.7273 68 -15.7982 < 2.2e-16 ***
Group1:Subject9                    0
Group1:Subject10  -274.273         0    18.7273 68 -14.6457 < 2.2e-16 ***
Group1:Subject11                   0
Group1:Subject12  -289.343         0    18.7273 68 -15.4504 < 2.2e-16 ***
Group1:Subject13  -244.527         0    18.7273 68 -13.0573 < 2.2e-16 ***
Group1:Subject14  -214.220         0    18.7273 68 -11.4389 < 2.2e-16 ***
Group1:Subject15                   0
```

```
Group1:Subject16                  0
Group1:Subject17                  0
Group1:Subject18  -256.807        0    18.7273 68 -13.7130 < 2.2e-16 ***
Group1:Subject19  -167.663        0    18.7273 68  -8.9529 4.106e-13 ***
Group1:Subject21  -196.253        0    18.7273 68 -10.4796 8.882e-16 ***
Group1:Subject23  -282.743        0    18.7273 68 -15.0980 < 2.2e-16 ***
Group1:Subject24                  0
Group1:Subject25                  0
Group1:Subject26  -175.620        0    18.7273 68  -9.3778 7.061e-14 ***
Group1:Subject27                  0
Group1:Subject28  -224.523        0    18.7273 68 -11.9891 < 2.2e-16 ***
Group1:Subject30                  0
Group1:Subject31  -231.780        0    18.7273 68 -12.3766 < 2.2e-16 ***
Group1:Subject32                  0
Group1:Subject33                  0
Group1:Subject34  -208.733        0    18.7273 68 -11.1460 < 2.2e-16 ***
Group1:Subject35                  0
Group1:Subject36  -236.827        0    18.7273 68 -12.6461 < 2.2e-16 ***
Group1:Subject120                 0
Group1:Subject122                 0
Group1:Subject129    0.000        0     0.0000 68
Group2:Subject1    -12.267        0    18.7273 68  -0.6550 0.5146667
Group2:Subject2                   0
Group2:Subject3                   0
Group2:Subject4     97.027        0    18.7273 68   5.1810 2.142e-06 ***
Group2:Subject5     67.423        0    18.7273 68   3.6003 0.0005992 ***
Group2:Subject6                   0
Group2:Subject7     20.703        0    18.7273 68   1.1055 0.2728310
Group2:Subject8                   0
Group2:Subject9     13.143        0    18.7273 68   0.7018 0.4851810
Group2:Subject10                  0
Group2:Subject11   102.857        0    18.7273 68   5.4924 6.396e-07 ***
Group2:Subject12                  0
Group2:Subject13                  0
Group2:Subject14                  0
Group2:Subject15    -1.000        0    18.7273 68  -0.0534 0.9575713
Group2:Subject16    47.123        0    18.7273 68   2.5163 0.0142246 *
Group2:Subject17     4.540        0    18.7273 68   0.2424 0.8091787
Group2:Subject18                  0
Group2:Subject19                  0
Group2:Subject21                  0
Group2:Subject23                  0
Group2:Subject24    25.713        0    18.7273 68   1.3730 0.1742498
Group2:Subject25    37.693        0    18.7273 68   2.0128 0.0481026 *
Group2:Subject26                  0
Group2:Subject27    29.563        0    18.7273 68   1.5786 0.1190628
Group2:Subject28                  0
Group2:Subject30     2.340        0    18.7273 68   0.1250 0.9009306
```

```
Group2:Subject31                    0
Group2:Subject32    58.270          0    18.7273 68   3.1115 0.0027208 **
Group2:Subject33    39.150          0    18.7273 68   2.0905 0.0403104 *
Group2:Subject34                    0
Group2:Subject35    14.293          0    18.7273 68   0.7632 0.4479620
Group2:Subject36                    0
Group2:Subject120   11.667          0    18.7273 68   0.6230 0.5353829
Group2:Subject122    0.000          0     0.0000 68
Group2:Subject129                   0
Period1             -1.329          0     6.0442 68  -0.2199 0.8265839
Period2             -1.454          0     5.4061 68  -0.2690 0.7887545
Period3              0.000          0     0.0000 68
TreatA              -9.594          0     4.6818 68  -2.0492 0.0443021 *
TreatB               0.000          0     0.0000 68
CarryA              -7.640          0     5.4061 68  -1.4132 0.1621674
CarryB               0.000          0     0.0000 68
Carrynone            0.000          0     0.0000 68
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

(179) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)   336.10         0    13.9585 68  24.0787 < 2.2e-16 ***
Subject1     -288.16         0    18.7922 68 -15.3340 < 2.2e-16 ***
Subject2     -227.03         0    18.7273 68 -12.1230 < 2.2e-16 ***
Subject3     -177.71         0    18.7273 68  -9.4896 4.441e-14 ***
Subject4     -178.87         0    18.7922 68  -9.5181 3.952e-14 ***
Subject5     -208.47         0    18.7922 68 -11.0934 < 2.2e-16 ***
Subject6      -40.34         0    18.7273 68  -2.1541   0.03478 *
Subject7     -255.19         0    18.7922 68 -13.5795 < 2.2e-16 ***
Subject8     -295.86         0    18.7273 68 -15.7982 < 2.2e-16 ***
Subject9     -262.75         0    18.7922 68 -13.9818 < 2.2e-16 ***
Subject10    -274.27         0    18.7273 68 -14.6457 < 2.2e-16 ***
Subject11    -173.04         0    18.7922 68  -9.2078 1.426e-13 ***
Subject12    -289.34         0    18.7273 68 -15.4504 < 2.2e-16 ***
Subject13    -244.53         0    18.7273 68 -13.0573 < 2.2e-16 ***
Subject14    -214.22         0    18.7273 68 -11.4389 < 2.2e-16 ***
Subject15    -276.89         0    18.7922 68 -14.7344 < 2.2e-16 ***
Subject16    -228.77         0    18.7922 68 -12.1736 < 2.2e-16 ***
Subject17    -271.35         0    18.7922 68 -14.4396 < 2.2e-16 ***
Subject18    -256.81         0    18.7273 68 -13.7130 < 2.2e-16 ***
Subject19    -167.66         0    18.7273 68  -8.9529 4.106e-13 ***
Subject21    -196.25         0    18.7273 68 -10.4796 8.882e-16 ***
Subject23    -282.74         0    18.7273 68 -15.0980 < 2.2e-16 ***
Subject24    -250.18         0    18.7922 68 -13.3129 < 2.2e-16 ***
Subject25    -238.20         0    18.7922 68 -12.6754 < 2.2e-16 ***
Subject26    -175.62         0    18.7273 68  -9.3778 7.061e-14 ***
Subject27    -246.33         0    18.7922 68 -13.1080 < 2.2e-16 ***
Subject28    -224.52         0    18.7273 68 -11.9891 < 2.2e-16 ***
Subject30    -273.55         0    18.7922 68 -14.5567 < 2.2e-16 ***
Subject31    -231.78         0    18.7273 68 -12.3766 < 2.2e-16 ***
Subject32    -217.62         0    18.7922 68 -11.5805 < 2.2e-16 ***
Subject33    -236.74         0    18.7922 68 -12.5979 < 2.2e-16 ***
Subject34    -208.73         0    18.7273 68 -11.1460 < 2.2e-16 ***
Subject35    -261.60         0    18.7922 68 -13.9206 < 2.2e-16 ***
Subject36    -236.83         0    18.7273 68 -12.6461 < 2.2e-16 ***
```

```
Subject120   -264.23         0    18.7922 68 -14.0604 < 2.2e-16 ***
Subject122   -275.89         0    18.7922 68 -14.6812 < 2.2e-16 ***
Subject129      0.00         0     0.0000 68
Period1        -1.33         0     6.0442 68  -0.2199   0.82658
Period2        -1.45         0     5.4061 68  -0.2690   0.78875
Period3         0.00         0     0.0000 68
TreatA         -9.59         0     4.6818 68  -2.0492   0.04430 *
TreatB          0.00         0     0.0000 68
CarryA         -7.64         0     5.4061 68  -1.4132   0.16217
CarryB          0.00         0     0.0000 68
Carrynone       0.00         0     0.0000 68
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.7.3 p361

(180) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)   7.2383         0   0.142461 18  50.8091 < 2.2e-16 ***
Subject1     -1.9179         0   0.134755 18 -14.2326 3.093e-11 ***
Subject2     -1.4912         0   0.134755 18 -11.0664 1.838e-09 ***
Subject3      0.4200         0   0.130732 18   3.2127 0.0048259 **
Subject4     -1.1700         0   0.130732 18  -8.9496 4.788e-08 ***
Subject5      0.3621         0   0.134755 18   2.6870 0.0150624 *
Subject6     -0.3046         0   0.134755 18  -2.2603 0.0364348 *
Subject7     -1.6946         0   0.134755 18 -12.5753 2.366e-10 ***
Subject8     -1.3746         0   0.134755 18 -10.2006 6.573e-09 ***
Subject9     -1.5446         0   0.134755 18 -11.4622 1.052e-09 ***
Subject10     0.1288         0   0.134755 18   0.9554 0.3520132
Subject11    -1.2033         0   0.130732 18  -9.2046 3.148e-08 ***
Subject12     0.0000         0   0.000000 18
Period1       0.4550         0   0.086471 18   5.2619 5.286e-05 ***
Period2      -0.0175         0   0.065366 18  -0.2677 0.7919554
Period3       0.0000         0   0.000000 18
Treat1       -0.2654         0   0.073081 18  -3.6318 0.0019073 **
Treat2       -0.3496         0   0.073081 18  -4.7835 0.0001487 ***
Treat3        0.0000         0   0.000000 18
Carry0        0.0000         0   0.000000 18
Carry1       -0.2337         0   0.098049 18  -2.3840 0.0283404 *
Carry2       -0.2737         0   0.098049 18  -2.7920 0.0120418 *
Carry3        0.0000         0   0.000000 18
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.7.4 p372

(181) MODEL

```r
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
```

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)              4.2566         0    0.19906  8 21.3832 2.407e-08 ***
temp10                   1.2582         0    0.28152  8  4.4695  0.002085 **
temp30                   0.0000         0    0.00000  8
moistureH               -0.3591         0    0.28152  8 -1.2757  0.237854
moistureL                0.0000         0    0.00000  8
temp10:moistureH         0.0358         0    0.39813  8  0.0900  0.930514
temp10:moistureL         0.0000         0    0.00000  8
temp30:moistureH         0.0000         0    0.00000  8
temp30:moistureL         0.0000         0    0.00000  8
soilC                    0.4772         0    0.28152  8  1.6950  0.128514
soilP                    0.0000         0    0.00000  8
temp10:soilC            -0.0209         0    0.39813  8 -0.0524  0.959466
temp10:soilP             0.0000         0    0.00000  8
temp30:soilC             0.0000         0    0.00000  8
temp30:soilP             0.0000         0    0.00000  8
moistureH:soilC         -0.2216         0    0.39813  8 -0.5567  0.592977
moistureH:soilP          0.0000         0    0.00000  8
moistureL:soilC          0.0000         0    0.00000  8
moistureL:soilP          0.0000         0    0.00000  8
temp10:moistureH:soilC  -0.1434         0    0.56303  8 -0.2546  0.805427
temp10:moistureH:soilP   0.0000         0    0.00000  8
temp10:moistureL:soilC   0.0000         0    0.00000  8
temp10:moistureL:soilP   0.0000         0    0.00000  8
temp30:moistureH:soilC   0.0000         0    0.00000  8
temp30:moistureH:soilP   0.0000         0    0.00000  8
temp30:moistureL:soilC   0.0000         0    0.00000  8
temp30:moistureL:soilP   0.0000         0    0.00000  8
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.8 Chapter 11

10.8.1 p461

(182) MODEL

```r
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 Df  t value  Pr(>|t|)
(Intercept)   65.375    0.52373  7 124.8256 5.587e-13 ***
x1           -16.482    0.72352  7 -22.7799 7.958e-08 ***
x2           -14.992    0.72864  7 -20.5752 1.608e-07 ***
x1:x2         -0.665    2.47759  7  -0.2684 0.7961658
x1:x3        -16.113    2.47759  7  -6.5037 0.0003330 ***
x2:x3        -16.919    2.59646  7  -6.5162 0.0003291 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.8.2 p469

(183) MODEL

```r
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 Df t value Pr(>|t|)
(Intercept)   1.2367     1.6150  5  0.7657  0.47840
```

```
x1            3.1892     1.4922  5  2.1372  0.08562 .
x2            2.2814     1.5047  5  1.5162  0.18992
x1:x2         6.9004     2.0179  5  3.4196  0.01885 *
x1:x3         8.9528     4.1427  5  2.1611  0.08307 .
x2:x3         5.3135     3.4988  5  1.5187  0.18931
x1:x2:x3     25.5460    11.2023  5  2.2804  0.07150 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.8.3 p482

(184) MODEL

```r
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 - 1, MPV) # OK
```

```
            Estimate Std. Error Df t value  Pr(>|t|)
x1            346948     294197 11  1.1793 0.2631550
x2              8223        490 11 16.7869 3.467e-09 ***
x3              1656        459 11  3.6104 0.0040950 **
x1:x2        -414463     312262 11 -1.3273 0.2113017
x1:x3        -334747     311426 11 -1.0749 0.3054382
x2:x3          -6476       1199 11 -5.4032 0.0002156 ***
x1:z1         103044     328922 11  0.3133 0.7599297
x2:z1          -2241        548 11 -4.0924 0.0017824 **
x3:z1            823        513 11  1.6056 0.1366709
x1:x2:z1      -64013     349120 11 -0.1834 0.8578546
x1:x3:z1     -123730     348184 11 -0.3554 0.7290412
x2:x3:z1        4659       1340 11  3.4765 0.0051806 **
x1:z2         244320     328922 11  0.7428 0.4731733
x2:z2            886        548 11  1.6187 0.1338108
x3:z2             86        513 11  0.1670 0.8704301
x1:x2:z2     -266052     349120 11 -0.7621 0.4620497
x1:x3:z2     -253151     348184 11 -0.7271 0.4823761
x2:x3:z2       -1822       1340 11 -1.3593 0.2012686
x1:z1:z2      259038     328922 11  0.7875 0.4476062
x2:z1:z2        -137        548 11 -0.2500 0.8071853
x3:z1:z2         100        513 11  0.1955 0.8485983
x1:x2:z1:z2  -269527     349120 11 -0.7720 0.4563702
x1:x3:z1:z2  -269249     348184 11 -0.7733 0.4556454
x2:x3:z1:z2     -328       1340 11 -0.2448 0.8111141
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.9 Chapter 12

10.9.1 p513

(185) 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 Df t value Pr(>|t|)
(Intercept)  0.74246             0
A            0.07893             0
```

```
B           -0.04990             0
C            0.25381             0
D           -0.04376             0
E            0.08635             0
F            0.03314             0
G           -0.04810             0
```

(186) MODEL

```r
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 Df t value Pr(>|t|)
(Intercept) -2.62342             0
A            0.45326             0
B           -0.19715             0
C            0.94775             0
D            0.53851             0
E            0.05564             0
F            0.30372             0
G           -0.10125             0
```

10.9.2 p521

(187) MODEL

```r
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 Df t value Pr(>|t|)
(Intercept)  0.74246    0.22704  1  3.2702   0.1889
A            0.07893    0.22704  1  0.3477   0.7870
A:H          0.05009    0.22704  1  0.2206   0.8618
B           -0.04990    0.22704  1 -0.2198   0.8623
H:B          0.00520    0.22704  1  0.0229   0.9854
C            0.25381    0.22704  1  1.1179   0.4646
H:C          0.09781    0.22704  1  0.4308   0.7410
D           -0.04376    0.22704  1 -0.1928   0.8788
H:D          0.05414    0.22704  1  0.2385   0.8510
E            0.08635    0.22704  1  0.3803   0.7686
H:E          0.03431    0.22704  1  0.1511   0.9045
F            0.03314    0.22704  1  0.1460   0.9077
H:F          0.02941    0.22704  1  0.1296   0.9180
G           -0.04810    0.22704  1 -0.2119   0.8671
```

```
H:G          0.01987    0.22704  1  0.0875   0.9444
```

10.9.3 p525

(188) MODEL

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)  23.9833         0    1.45344 24 16.5010 1.332e-14 ***
A1           -4.1208         0    1.14905 24 -3.5863  0.001487 **
A2           -0.1792         0    1.14905 24 -0.1559  0.877395
A3            0.0000         0    0.00000 24
B1           -1.9500         0    1.02774 24 -1.8974  0.069875 .
B2           -0.3000         0    1.02774 24 -0.2919  0.772869
B3            0.0000         0    0.00000 24
C1            0.3000         0    1.45344 24  0.2064  0.838215
C2            2.6333         0    1.45344 24  1.8118  0.082552 .
C3            0.0000         0    0.00000 24
D1            1.6042         0    0.89005 24  1.8023  0.084067 .
D2            0.2958         0    0.89005 24  0.3324  0.742489
D3            0.0000         0    0.00000 24
E1           -4.2111         0    1.96797 24 -2.1398  0.042742 *
E2            0.0000         0    0.00000 24
F1           -3.1556         0    1.78010 24 -1.7727  0.088975 .
F2            0.0000         0    0.00000 24
G1            0.0889         0    1.78010 24  0.0499  0.960588
```

G2	0.0000	0	0.00000	24			
A1:G1	2.9750	0	1.02774	24	2.8947	0.007959	**
A1:G2	0.0000	0	0.00000	24			
A2:G1	1.4250	0	1.02774	24	1.3865	0.178329	
A2:G2	0.0000	0	0.00000	24			
A3:G1	0.0000	0	0.00000	24			
A3:G2	0.0000	0	0.00000	24			
A1:E1:F1	2.2667	0	2.78313	24	0.8144	0.423407	
A1:E1:F2	2.6333	0	1.45344	24	1.8118	0.082552	.
A1:E2:F1	2.7833	0	1.45344	24	1.9150	0.067486	.
A1:E2:F2	0.0000	0	0.00000	24			
A2:E1:F1	1.9667	0	2.78313	24	0.7066	0.486596	
A2:E1:F2	1.3500	0	1.45344	24	0.9288	0.362226	
A2:E2:F1	-0.1000	0	1.45344	24	-0.0688	0.945717	
A2:E2:F2	0.0000	0	0.00000	24			
A3:E1:F1	1.6333	0	2.37346	24	0.6882	0.497948	
A3:E1:F2	0.0000	0	0.00000	24			
A3:E2:F1	0.0000	0	0.00000	24			
A3:E2:F2	0.0000	0	0.00000	24			
B1:E1:G1	-1.6278	0	2.78313	24	-0.5849	0.564092	
B1:E1:G2	2.3667	0	1.45344	24	1.6283	0.116516	
B1:E2:G1	1.3000	0	1.45344	24	0.8944	0.379976	
B1:E2:G2	0.0000	0	0.00000	24			
B2:E1:G1	-3.5611	0	2.78313	24	-1.2795	0.212941	
B2:E1:G2	1.3500	0	1.45344	24	0.9288	0.362226	
B2:E2:G1	1.8333	0	1.45344	24	1.2614	0.219298	
B2:E2:G2	0.0000	0	0.00000	24			
B3:E1:G1	-3.1611	0	2.37346	24	-1.3319	0.195419	
B3:E1:G2	0.0000	0	0.00000	24			
B3:E2:G1	0.0000	0	0.00000	24			
B3:E2:G2	0.0000	0	0.00000	24			
C1:E1:G1	-1.9333	0	2.05548	24	-0.9406	0.356294	
C1:E1:G2	-2.9000	0	2.05548	24	-1.4109	0.171117	
C1:E2:G1	-3.4333	0	2.05548	24	-1.6703	0.107846	
C1:E2:G2	0.0000	0	0.00000	24			
C2:E1:G1	-2.4000	0	2.05548	24	-1.1676	0.254434	
C2:E1:G2	-5.5667	0	2.05548	24	-2.7082	0.012273	*
C2:E2:G1	-4.3333	0	2.05548	24	-2.1082	0.045643	*
C2:E2:G2	0.0000	0	0.00000	24			
C3:E1:G1	0.0000	0	0.00000	24			
C3:E1:G2	0.0000	0	0.00000	24			
C3:E2:G1	0.0000	0	0.00000	24			
C3:E2:G2	0.0000	0	0.00000	24			
C1:E1:F1:G1	1.3000	0	2.05548	24	0.6325	0.533069	
C1:E1:F1:G2	-1.7333	0	2.05548	24	-0.8433	0.407402	
C1:E1:F2:G1	0.0000	0	0.00000	24			
C1:E1:F2:G2	0.0000	0	0.00000	24			
C1:E2:F1:G1	-1.5000	0	2.05548	24	-0.7298	0.472602	

```
C1:E2:F1:G2  -0.1000         0    2.05548 24 -0.0487  0.961600
C1:E2:F2:G1   0.0000         0    0.00000 24
C1:E2:F2:G2   0.0000         0    0.00000 24
C2:E1:F1:G1   0.5667         0    2.05548 24  0.2757  0.785149
C2:E1:F1:G2   2.6333         0    2.05548 24  1.2811  0.212390
C2:E1:F2:G1   0.0000         0    0.00000 24
C2:E1:F2:G2   0.0000         0    0.00000 24
C2:E2:F1:G1   0.9667         0    2.05548 24  0.4703  0.642395
C2:E2:F1:G2  -1.5667         0    2.05548 24 -0.7622  0.453373
C2:E2:F2:G1   0.0000         0    0.00000 24
C2:E2:F2:G2   0.0000         0    0.00000 24
C3:E1:F1:G1   1.8000         0    2.05548 24  0.8757  0.389869
C3:E1:F1:G2   0.0000         0    0.00000 24
C3:E1:F2:G1   0.0000         0    0.00000 24
C3:E1:F2:G2   0.0000         0    0.00000 24
C3:E2:F1:G1  -0.3333         0    2.05548 24 -0.1622  0.872531
C3:E2:F1:G2   0.0000         0    0.00000 24
C3:E2:F2:G1   0.0000         0    0.00000 24
C3:E2:F2:G2   0.0000         0    0.00000 24
D1:E1        -0.2583         0    1.02774 24 -0.2514  0.803675
D1:E2         0.0000         0    0.00000 24
D2:E1         2.1917         0    1.02774 24  2.1325  0.043397 *
D2:E2         0.0000         0    0.00000 24
D3:E1         0.0000         0    0.00000 24
D3:E2         0.0000         0    0.00000 24
D1:F1        -0.2417         0    1.02774 24 -0.2351  0.816092
D1:F2         0.0000         0    0.00000 24
D2:F1        -2.0750         0    1.02774 24 -2.0190  0.054793 .
D2:F2         0.0000         0    0.00000 24
D3:F1         0.0000         0    0.00000 24
D3:F2         0.0000         0    0.00000 24
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.9.4 p532

(189) MODEL

```r
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 Estimable Std. Error Df  t value  Pr(>|t|)
(Intercept)  0.289577         0  0.0034044  2  85.0589 0.0001382 ***
A1          -0.032740         0  0.0042779  2  -7.6533 0.0166477 *
A2           0.000000         0  0.0000000  2
B1          -0.009206         0  0.0022091  2  -4.1673 0.0530418 .
```

```
B2           0.013405         0  0.0022091  2   6.0681 0.0260991 *
B3           0.000000         0  0.0000000  2
C1          -0.040333         0  0.0030249  2 -13.3336 0.0055778 **
C2          -0.023615         0  0.0030249  2  -7.8068 0.0160147 *
C3           0.000000         0  0.0000000  2
D1           0.004119         0  0.0030249  2   1.3617 0.3063965
D2           0.004196         0  0.0027056  2   1.5509 0.2610866
D3           0.000000         0  0.0000000  2
E1          -0.001008         0  0.0027056  2  -0.3726 0.7452485
E2           0.000000         0  0.0000000  2
A1:B1        0.029389         0  0.0031241  2   9.4070 0.0111124 *
A1:B2       -0.004253         0  0.0031241  2  -1.3612 0.3065165
A1:B3        0.000000         0  0.0000000  2
A2:B1        0.000000         0  0.0000000  2
A2:B2        0.000000         0  0.0000000  2
A2:B3        0.000000         0  0.0000000  2
A1:C1       -0.002699         0  0.0042779  2  -0.6310 0.5925465
A1:C2       -0.001250         0  0.0042779  2  -0.2923 0.7976178
A1:C3        0.000000         0  0.0000000  2
A2:C1        0.000000         0  0.0000000  2
A2:C2        0.000000         0  0.0000000  2
A2:C3        0.000000         0  0.0000000  2
A1:D1       -0.003579         0  0.0042779  2  -0.8367 0.4908121
A1:D2       -0.001141         0  0.0038262  2  -0.2983 0.7935889
A1:D3        0.000000         0  0.0000000  2
A2:D1        0.000000         0  0.0000000  2
A2:D2        0.000000         0  0.0000000  2
A2:D3        0.000000         0  0.0000000  2
A1:E1       -0.007178         0  0.0038262  2  -1.8761 0.2014578
A1:E2        0.000000         0  0.0000000  2
A2:E1        0.000000         0  0.0000000  2
A2:E2        0.000000         0  0.0000000  2
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.9.5 p535

(190) MODEL

```r
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 Df t value  Pr(>|t|)
(Intercept)  27.1000    0.42924  5 63.1343 1.887e-08 ***
A             6.9375    0.47991  5 14.4559 2.858e-05 ***
B            17.8125    0.47991  5 37.1164 2.674e-07 ***
C            -0.4375    0.47991  5 -0.9116  0.403773
D             0.6875    0.47991  5  1.4326  0.211416
E             0.1875    0.47991  5  0.3907  0.712112
F             0.1875    0.47991  5  0.3907  0.712112
G            -2.4375    0.47991  5 -5.0791  0.003837 **
A:B           5.9375    0.47991  5 12.3721 6.112e-05 ***
A:C          -0.8125    0.47991  5 -1.6930  0.151230
A:D          -2.6875    0.47991  5 -5.6000  0.002508 **
A:E          -0.9375    0.47991  5 -1.9535  0.108185
A:F           0.3125    0.47991  5  0.6512  0.543677
A:G          -0.0625    0.47991  5 -0.1302  0.901459
B:D          -0.0625    0.47991  5 -0.1302  0.901459
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.9.6 p539

(191) MODEL

```r
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 Df t value Pr(>|t|)
(Intercept)  14.3612             0
A            -0.0410             0
B             0.0051             0
C            -0.0628             0
D            -0.3948             0
E            -0.0138             0
F             0.0448             0
G            -0.0430             0
H             0.0897             0
A:B           0.0054             0
A:C          -0.0448             0
A:D           0.0272             0
A:E           0.0154             0
A:F           0.0323             0
A:G          -0.0108             0
A:H           0.0028             0
```

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%)

(192) 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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)                 12         0     1.1832 10 10.1419 1.397e-06 ***
treatmentta                 -3         0     2.0494 10 -1.4639   0.17395
treatmenttb                  5         0     2.3664 10  2.1129   0.06075 .
treatmenttc                  0         0     0.0000 10
varietyva                   -8         0     3.1305 10 -2.5555   0.02859 *
varietyvb                   -4         0     2.0494 10 -1.9518   0.07951 .
varietyvc                    3         0     2.0494 10  1.4639   0.17395
varietyvd                    0         0     0.0000 10
treatmentta:varietyva        9         0     3.8035 10  2.3662   0.03953 *
treatmentta:varietyvb                  0
treatmentta:varietyvc        0         0     3.5496 10  0.0000   1.00000
treatmentta:varietyvd        0         0     0.0000 10
treatmenttb:varietyva        0         0     0.0000 10
treatmenttb:varietyvb        0         0     0.0000 10
treatmenttb:varietyvc                  0
treatmenttb:varietyvd                  0
treatmenttc:varietyva                  0
treatmenttc:varietyvb        0         0     0.0000 10
treatmenttc:varietyvc        0         0     0.0000 10
treatmenttc:varietyvd        0         0     0.0000 10
---
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%)

(193) MODEL

```r
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))
```

```r
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 Estimable Std. Error Df t value  Pr(>|t|)
(Intercept)         42.000         0     8.3409 14  5.0354 0.0001822 ***
refineryg           -2.000         0     9.0093 14 -0.2220 0.8275243
refineryn           -3.000         0    11.7959 14 -0.2543 0.8029412
refinerys            0.000         0     0.0000 14
sourcei             -8.000         0     9.6313 14 -0.8306 0.4201255
sourcem            -16.000         0    11.7959 14 -1.3564 0.1964425
sourceo             -0.667         0     9.6313 14 -0.0692 0.9457944
sourcet              0.000         0     0.0000 14
refineryg:sourcei                  0
refineryg:sourcem    2.000         0    14.8428 14  0.1347 0.8947314
refineryg:sourceo    0.667         0    11.7959 14  0.0565 0.9557287
refineryg:sourcet    0.000         0     0.0000 14
refineryn:sourcei    3.667         0    13.6207 14  0.2692 0.7917042
refineryn:sourcem   14.333         0    15.2284 14  0.9412 0.3625491
```

```
refineryn:sourceo   -2.333         0    15.2284 14 -0.1532 0.8804095
refineryn:sourcet    0.000         0     0.0000 14
refinerys:sourcei    0.000         0     0.0000 14
refinerys:sourcem    0.000         0     0.0000 14
refinerys:sourceo    0.000         0     0.0000 14
refinerys:sourcet    0.000         0     0.0000 14
---
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	0.5.3	193	193 (100%)	0 (0%)
car	3.0.10	193	< 174 (90%)	>= 20 (10%)

All of the results in sasLM 0.5.3 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 4.0.5 (2021-03-31)
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_1.2-7   car_3.0-10    carData_3.0-4 sasLM_0.5.3   rmarkdown_2.7

loaded via a namespace (and not attached):
 [1] zoo_1.8-9            xfun_0.20            partitions_1.10-2
 [4] haven_2.3.1          lattice_0.20-41      colorspace_2.0-0
 [7] vctrs_0.3.7          htmltools_0.5.1.1    yaml_2.2.1
[10] gmp_0.6-2            utf8_1.2.1           rlang_0.4.10
[13] pillar_1.5.1         foreign_0.8-81       readxl_1.3.1
[16] lifecycle_1.0.0      stringr_1.4.0        combinat_0.0-8
[19] cellranger_1.1.0     DoE.base_1.1-6       zip_2.1.1
[22] evaluate_0.14        knitr_1.31           rio_0.5.26
[25] forcats_0.5.1        lmtest_0.9-38        curl_4.3
[28] numbers_0.7-5        fansi_0.4.2          vcd_1.4-8
[31] conf.design_2.0.0    Rcpp_1.0.6           polynom_1.4-0
[34] scatterplot3d_0.3-41 abind_1.4-5          FrF2_2.2-2
[37] hms_1.0.0            digest_0.6.27        stringi_1.5.3
[40] openxlsx_4.2.3       grid_4.0.5           mathjaxr_1.4-0
[43] tools_4.0.5          magrittr_2.0.1       tibble_3.1.0
[46] crayon_1.4.1         pkgconfig_2.0.3      MASS_7.3-53.1
[49] ellipsis_0.3.1       data.table_1.14.0    sfsmisc_1.1-10
[52] igraph_1.2.6         compiler_4.0.5
```