

Validation of 'sasLM' Package

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1 Tested Version and Books used for the Validation

1.1 Packages Used

- 'sasLM' version: 0.5.1
- 'SAS' version: 9.4 Licensed and University Edition
- 'car' version: 3.0.10
- R version: R version 4.0.4 (2021-02-15)

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

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

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

2.3 p101

(4) MODEL

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

\$ANOVA

Response : Gain

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	16	2.4972	0.156073	3.0675	0.001364 **
RESIDUALS	48	2.4422	0.050879		
CORRECTED TOTAL	64	4.9394			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Line	2	0.38009	0.190046	3.7352	0.03107 *
Sire	6	0.92634	0.154391	3.0345	0.01347 *
Dam	2	0.11894	0.059471	1.1689	0.31940
Line:Dam	4	0.64889	0.162222	3.1884	0.02113 *
Age	1	0.16462	0.164622	3.2356	0.07835 .
Weight	1	0.25828	0.258283	5.0764	0.02886 *

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Line	0				
Sire	6	0.95299	0.15883	3.1217	0.01155 *
Dam	2	0.32039	0.16019	3.1485	0.05190 .
Line:Dam	4	0.46516	0.11629	2.2856	0.07373 .
Age	1	0.34830	0.34830	6.8456	0.01185 *
Weight	1	0.25828	0.25828	5.0764	0.02886 *

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

\$`Type III`

CAUTION: Singularity Exists !

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


```
Weight    1 0.25828 0.25828  5.0764 0.02886 *
```

```
---
```

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

```
$Parameter
```

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	2.95068	0.51867	48	5.6889	7.461e-07 ***
Line1	0.08058	0.14600	48	0.5519	0.583562
Line2	0.25898	0.13801	48	1.8765	0.066672 .
Line3	0.00000	0.00000	48		
Sire1	0.07353	0.13054	48	0.5633	0.575872
Sire2	-0.12448	0.13720	48	-0.9072	0.368814
Sire3	0.00000	0.00000	48		
Sire4	-0.23837	0.12753	48	-1.8692	0.067704 .
Sire5	0.00000	0.00000	48		
Sire6	0.10359	0.13013	48	0.7960	0.429928
Sire7	-0.02129	0.12129	48	-0.1756	0.861372
Sire8	-0.33135	0.12662	48	-2.6168	0.011834 *
Sire9	0.00000	0.00000	48		
Dam3	0.36999	0.11530	48	3.2090	0.002375 **
Dam4	0.27711	0.10444	48	2.6533	0.010777 *
Dam5	0.00000	0.00000	48		
Line1:Dam3	-0.44415	0.19686	48	-2.2562	0.028649 *
Line1:Dam4	-0.30365	0.16070	48	-1.8896	0.064862 .
Line1:Dam5	0.00000	0.00000	48		
Line2:Dam3	-0.26743	0.19635	48	-1.3620	0.179554
Line2:Dam4	-0.35600	0.17540	48	-2.0297	0.047954 *
Line2:Dam5	0.00000	0.00000	48		
Line3:Dam3	0.00000	0.00000	48		
Line3:Dam4	0.00000	0.00000	48		
Line3:Dam5	0.00000	0.00000	48		
Age	-0.00815	0.00312	48	-2.6164	0.011845 *
Weight	0.00197	0.00087	48	2.2531	0.028860 *

```
---
```

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

(5) MODEL

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

```
$ANOVA
```

```
Response : Gain
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	14	2.0743	0.148162	2.5856	0.006996 **
RESIDUALS	50	2.8651	0.057302		
CORRECTED TOTAL	64	4.9394			

```
---
```

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Sire	8	1.30644	0.163305	2.8499	0.01089 *
Dam	2	0.11894	0.059471	1.0379	0.36172
Dam:Line	4	0.64889	0.162222	2.8310	0.03412 *

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Sire	6	1.06000	0.176667	3.0831	0.01202 *
Dam	2	0.11894	0.059471	1.0379	0.36172
Dam:Line	4	0.64889	0.162222	2.8310	0.03412 *

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

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Sire	6	1.06000	0.176667	3.0831	0.01202 *
Dam	2	0.02569	0.012844	0.2242	0.79999
Dam:Line	4	0.64889	0.162222	2.8310	0.03412 *

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	2.35075	0.09704	50	24.2246	< 2.2e-16 ***
Sire1	0.20311	0.14084	50	1.4422	0.155488
Sire2	-0.06287	0.13258	50	-0.4742	0.637414
Sire3	0.16834	0.15153	50	1.1109	0.271905
Sire4	0.18107	0.14313	50	1.2650	0.211718
Sire5	0.31743	0.14313	50	2.2178	0.031143 *
Sire6	-0.01585	0.13038	50	-0.1215	0.903749
Sire7	-0.11844	0.12299	50	-0.9630	0.340164
Sire8	-0.42213	0.13012	50	-3.2442	0.002102 **
Sire9	0.00000	0.00000	50		
Dam3	0.33813	0.12177	50	2.7768	0.007706 **
Dam4	0.27529	0.11078	50	2.4849	0.016348 *
Dam5	0.00000	0.00000	50		
Dam3:Line1	-0.45707	0.20303	50	-2.2512	0.028796 *
Dam3:Line2	-0.38540	0.20378	50	-1.8913	0.064384 .
Dam3:Line3	0.00000	0.00000	50		
Dam4:Line1	-0.38180	0.16807	50	-2.2717	0.027443 *
Dam4:Line2	-0.43029	0.18374	50	-2.3418	0.023215 *
Dam4:Line3	0.00000	0.00000	50		

```
Dam5:Line1  0.00000  0.00000 50
Dam5:Line2  0.00000  0.00000 50
Dam5:Line3  0.00000  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	Std. Error	Df	t value	Pr(> t)
(Intercept)	6.8		0		
Day1	2.0		0		
Day2	1.3		0		

Day3	0.6	0
Day4	1.2	0
Day5	2.7	0
Day6	2.4	0
Day7	6.0	0
Day8	2.4	0
Day9	4.5	0
Day10	2.5	0
Day11	-2.8	0
Day12	2.9	0
Day13	-2.2	0
Day14	-4.7	0
Day15	2.9	0
Day16	3.2	0
Day17	3.4	0
Day18	2.4	0
Day19	4.0	0
Day20	2.6	0
Day21	3.5	0
Day22	3.5	0
Day23	1.5	0
Day24	4.8	0
Day25	2.6	0
Day26	4.5	0
Day27	4.6	0
Day28	2.8	0
Day29	-4.6	0
Day30	-0.2	0
Day31	4.7	0
Day32	2.3	0
Day33	-2.2	0
Day34	1.1	0
Day35	2.2	0
Day36	1.3	0
Day37	2.6	0
Day38	4.1	0
Day39	2.2	0
Day40	1.0	0
Day41	2.5	0
Day42	0.0	0
Day1:Machine1	-2.2	0
Day1:Machine2	0.0	0
Day2:Machine1	0.1	0
Day2:Machine2	0.0	0
Day3:Machine1	0.6	0
Day3:Machine2	0.0	0
Day4:Machine1	-1.5	0
Day4:Machine2	0.0	0

Day5:Machine1	-7.2	0
Day5:Machine2	0.0	0
Day6:Machine1	-5.2	0
Day6:Machine2	0.0	0
Day7:Machine1	-1.1	0
Day7:Machine2	0.0	0
Day8:Machine1	-2.4	0
Day8:Machine2	0.0	0
Day9:Machine1	-0.8	0
Day9:Machine2	0.0	0
Day10:Machine1	1.0	0
Day10:Machine2	0.0	0
Day11:Machine1	6.0	0
Day11:Machine2	0.0	0
Day12:Machine1	-0.9	0
Day12:Machine2	0.0	0
Day13:Machine1	2.1	0
Day13:Machine2	0.0	0
Day14:Machine1	6.8	0
Day14:Machine2	0.0	0
Day15:Machine1	0.2	0
Day15:Machine2	0.0	0
Day16:Machine1	-1.8	0
Day16:Machine2	0.0	0
Day17:Machine1	-2.7	0
Day17:Machine2	0.0	0
Day18:Machine1	-2.6	0
Day18:Machine2	0.0	0
Day19:Machine1	-7.7	0
Day19:Machine2	0.0	0
Day20:Machine1	-2.2	0
Day20:Machine2	0.0	0
Day21:Machine1	0.4	0
Day21:Machine2	0.0	0
Day22:Machine1	-1.9	0
Day22:Machine2	0.0	0
Day23:Machine1	-0.7	0
Day23:Machine2	0.0	0
Day24:Machine1	1.0	0
Day24:Machine2	0.0	0
Day25:Machine1	0.2	0
Day25:Machine2	0.0	0
Day26:Machine1	1.3	0
Day26:Machine2	0.0	0
Day27:Machine1	-0.6	0
Day27:Machine2	0.0	0
Day28:Machine1	-4.5	0
Day28:Machine2	0.0	0

Day29:Machine1	4.4	0
Day29:Machine2	0.0	0
Day30:Machine1	2.0	0
Day30:Machine2	0.0	0
Day31:Machine1	1.0	0
Day31:Machine2	0.0	0
Day32:Machine1	1.3	0
Day32:Machine2	0.0	0
Day33:Machine1	6.0	0
Day33:Machine2	0.0	0
Day34:Machine1	-0.7	0
Day34:Machine2	0.0	0
Day35:Machine1	-1.2	0
Day35:Machine2	0.0	0
Day36:Machine1	-3.7	0
Day36:Machine2	0.0	0
Day37:Machine1	-0.7	0
Day37:Machine2	0.0	0
Day38:Machine1	0.3	0
Day38:Machine2	0.0	0
Day39:Machine1	1.3	0
Day39:Machine2	0.0	0
Day40:Machine1	-0.8	0
Day40:Machine2	0.0	0
Day41:Machine1	-1.6	0
Day41:Machine2	0.0	0
Day42:Machine1	0.8	0
Day42:Machine2	0.0	0
Day1:Machine1:Analyst1	0.0	0
Day1:Machine1:Analyst2	0.0	0
Day1:Machine2:Analyst1	0.0	0
Day1:Machine2:Analyst2		
Day2:Machine1:Analyst1	1.4	0
Day2:Machine1:Analyst2	0.0	0
Day2:Machine2:Analyst1	0.0	0
Day2:Machine2:Analyst2		
Day3:Machine1:Analyst1	-1.3	0
Day3:Machine1:Analyst2	0.0	0
Day3:Machine2:Analyst1	0.0	0
Day3:Machine2:Analyst2		
Day4:Machine1:Analyst1	0.7	0
Day4:Machine1:Analyst2	0.0	0
Day4:Machine2:Analyst1	0.0	0
Day4:Machine2:Analyst2		
Day5:Machine1:Analyst1	4.8	0
Day5:Machine1:Analyst2	0.0	0
Day5:Machine2:Analyst1	0.0	0
Day5:Machine2:Analyst2		

Day6:Machine1:Analyst1	5.0	0
Day6:Machine1:Analyst2	0.0	0
Day6:Machine2:Analyst1	0.0	0
Day6:Machine2:Analyst2		
Day7:Machine1:Analyst1	-1.9	0
Day7:Machine1:Analyst2	0.0	0
Day7:Machine2:Analyst1	0.0	0
Day7:Machine2:Analyst2		
Day8:Machine1:Analyst1	1.2	0
Day8:Machine1:Analyst2	0.0	0
Day8:Machine2:Analyst1	0.0	0
Day8:Machine2:Analyst2		
Day9:Machine1:Analyst1	0.4	0
Day9:Machine1:Analyst2	0.0	0
Day9:Machine2:Analyst1	0.0	0
Day9:Machine2:Analyst2		
Day10:Machine1:Analyst1	0.3	0
Day10:Machine1:Analyst2	0.0	0
Day10:Machine2:Analyst1	0.0	0
Day10:Machine2:Analyst2		
Day11:Machine1:Analyst1	-1.6	0
Day11:Machine1:Analyst2	0.0	0
Day11:Machine2:Analyst1	0.0	0
Day11:Machine2:Analyst2		
Day12:Machine1:Analyst1	1.8	0
Day12:Machine1:Analyst2	0.0	0
Day12:Machine2:Analyst1	0.0	0
Day12:Machine2:Analyst2		
Day13:Machine1:Analyst1	0.5	0
Day13:Machine1:Analyst2	0.0	0
Day13:Machine2:Analyst1	0.0	0
Day13:Machine2:Analyst2		
Day14:Machine1:Analyst1	-0.9	0
Day14:Machine1:Analyst2	0.0	0
Day14:Machine2:Analyst1	0.0	0
Day14:Machine2:Analyst2		
Day15:Machine1:Analyst1	-1.2	0
Day15:Machine1:Analyst2	0.0	0
Day15:Machine2:Analyst1	0.0	0
Day15:Machine2:Analyst2		
Day16:Machine1:Analyst1	0.5	0
Day16:Machine1:Analyst2	0.0	0
Day16:Machine2:Analyst1	0.0	0
Day16:Machine2:Analyst2		
Day17:Machine1:Analyst1	-0.7	0
Day17:Machine1:Analyst2	0.0	0
Day17:Machine2:Analyst1	0.0	0
Day17:Machine2:Analyst2		

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

Day30:Machine1:Analyst1	-1.6	0
Day30:Machine1:Analyst2	0.0	0
Day30:Machine2:Analyst1	0.0	0
Day30:Machine2:Analyst2		
Day31:Machine1:Analyst1	-3.3	0
Day31:Machine1:Analyst2	0.0	0
Day31:Machine2:Analyst1	0.0	0
Day31:Machine2:Analyst2		
Day32:Machine1:Analyst1	1.3	0
Day32:Machine1:Analyst2	0.0	0
Day32:Machine2:Analyst1	0.0	0
Day32:Machine2:Analyst2		
Day33:Machine1:Analyst1	0.0	0
Day33:Machine1:Analyst2	0.0	0
Day33:Machine2:Analyst1	0.0	0
Day33:Machine2:Analyst2		
Day34:Machine1:Analyst1	3.2	0
Day34:Machine1:Analyst2	0.0	0
Day34:Machine2:Analyst1	0.0	0
Day34:Machine2:Analyst2		
Day35:Machine1:Analyst1	0.6	0
Day35:Machine1:Analyst2	0.0	0
Day35:Machine2:Analyst1	0.0	0
Day35:Machine2:Analyst2		
Day36:Machine1:Analyst1	2.4	0
Day36:Machine1:Analyst2	0.0	0
Day36:Machine2:Analyst1	0.0	0
Day36:Machine2:Analyst2		
Day37:Machine1:Analyst1	1.4	0
Day37:Machine1:Analyst2	0.0	0
Day37:Machine2:Analyst1	0.0	0
Day37:Machine2:Analyst2		
Day38:Machine1:Analyst1	-0.2	0
Day38:Machine1:Analyst2	0.0	0
Day38:Machine2:Analyst1	0.0	0
Day38:Machine2:Analyst2		
Day39:Machine1:Analyst1	-0.3	0
Day39:Machine1:Analyst2	0.0	0
Day39:Machine2:Analyst1	0.0	0
Day39:Machine2:Analyst2		
Day40:Machine1:Analyst1	1.0	0
Day40:Machine1:Analyst2	0.0	0
Day40:Machine2:Analyst1	0.0	0
Day40:Machine2:Analyst2		
Day41:Machine1:Analyst1	-0.5	0
Day41:Machine1:Analyst2	0.0	0
Day41:Machine2:Analyst1	0.0	0
Day41:Machine2:Analyst2		

Day42:Machine1:Analyst1	1.2	0
Day42:Machine1:Analyst2	0.0	0
Day42:Machine2:Analyst1	0.0	0
Day42:Machine2:Analyst2		
Day1:Machine1:Analyst1:Test1	-0.5	0
Day1:Machine1:Analyst1:Test2	0.0	0
Day1:Machine1:Analyst2:Test1	0.0	0
Day1:Machine1:Analyst2:Test2		
Day1:Machine2:Analyst1:Test1	0.0	0
Day1:Machine2:Analyst1:Test2		
Day1:Machine2:Analyst2:Test1		
Day1:Machine2:Analyst2:Test2		
Day2:Machine1:Analyst1:Test1	-1.1	0
Day2:Machine1:Analyst1:Test2	0.0	0
Day2:Machine1:Analyst2:Test1	0.0	0
Day2:Machine1:Analyst2:Test2		
Day2:Machine2:Analyst1:Test1	0.0	0
Day2:Machine2:Analyst1:Test2		
Day2:Machine2:Analyst2:Test1		
Day2:Machine2:Analyst2:Test2		
Day3:Machine1:Analyst1:Test1	1.9	0
Day3:Machine1:Analyst1:Test2	0.0	0
Day3:Machine1:Analyst2:Test1	0.0	0
Day3:Machine1:Analyst2:Test2		
Day3:Machine2:Analyst1:Test1	0.0	0
Day3:Machine2:Analyst1:Test2		
Day3:Machine2:Analyst2:Test1		
Day3:Machine2:Analyst2:Test2		
Day4:Machine1:Analyst1:Test1	2.1	0
Day4:Machine1:Analyst1:Test2	0.0	0
Day4:Machine1:Analyst2:Test1	0.0	0
Day4:Machine1:Analyst2:Test2		
Day4:Machine2:Analyst1:Test1	0.0	0
Day4:Machine2:Analyst1:Test2		
Day4:Machine2:Analyst2:Test1		
Day4:Machine2:Analyst2:Test2		
Day5:Machine1:Analyst1:Test1	1.0	0
Day5:Machine1:Analyst1:Test2	0.0	0
Day5:Machine1:Analyst2:Test1	0.0	0
Day5:Machine1:Analyst2:Test2		
Day5:Machine2:Analyst1:Test1	0.0	0
Day5:Machine2:Analyst1:Test2		
Day5:Machine2:Analyst2:Test1		
Day5:Machine2:Analyst2:Test2		
Day6:Machine1:Analyst1:Test1	-0.5	0
Day6:Machine1:Analyst1:Test2	0.0	0
Day6:Machine1:Analyst2:Test1	0.0	0
Day6:Machine1:Analyst2:Test2		

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

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

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

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

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

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

```
Day42:Machine2:Analyst1:Test1      0.0      0
Day42:Machine2:Analyst1:Test2
Day42:Machine2:Analyst2:Test1
Day42:Machine2:Analyst2:Test2
```

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

4 Goodnight

Reference

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

4.1 Type I SS

4.1.1 p7

(7) MODEL

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

\$ANOVA

Response : y

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

\$`Type I`

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

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

\$`Type II`

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

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

\$`Type III`

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

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	6.610	0.8987	4	7.3551	0.00182 **
A1	-1.465	1.2710	4	-1.1527	0.31324
A2	0.000	0.0000	4		
B1	0.050	1.2710	4	0.0393	0.97050
B2	0.000	0.0000	4		
A1:B1	-1.720	1.7974	4	-0.9569	0.39279
A1:B2	0.000	0.0000	4		
A2:B1	0.000	0.0000	4		
A2:B2	0.000	0.0000	4		

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

(8) MODEL

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

\$ANOVA

Response : y

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	10.8113	10.8113	6.6929	0.06087 .
A:B	2	2.7914	1.3957	0.8640	0.48764
B	0				

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

\$`Type II`

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

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

\$`Type III`

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

```
B      1  1.3122  1.3122  0.8123 0.41839
```

```
---
```

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

```
$Parameter
```

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	6.610	0.8987	4	7.3551	0.00182 **
A1	-1.465	1.2710	4	-1.1527	0.31324
A2	0.000	0.0000	4		
A1:B1	-1.670	1.2710	4	-1.3140	0.25914
A1:B2	0.000	0.0000	4		
A2:B1	0.050	1.2710	4	0.0393	0.97050
A2:B2	0.000	0.0000	4		
B1	0.000	0.0000	4		
B2	0.000	0.0000	4		

```
---
```

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

(9) MODEL

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

```
$ANOVA
```

```
Response : y
```

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

```
$`Type I`
```

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

```
---
```

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

```
$`Type II`
```

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

```
---
```

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

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
--	----	--------	---------	---------	--------

```

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

```

```

$Parameter
      Estimate Std. Error Df t value Pr(>|t|)
(Intercept)   6.610     0.8987  4  7.3551  0.00182 **
B1             0.050     1.2710  4  0.0393  0.97050
B2             0.000     0.0000  4
A1            -1.465     1.2710  4 -1.1527  0.31324
A2             0.000     0.0000  4
B1:A1         -1.720     1.7974  4 -0.9569  0.39279
B1:A2          0.000     0.0000  4
B2:A1          0.000     0.0000  4
B2:A2          0.000     0.0000  4
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

(10) MODEL

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

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```

```

$Parameter
      Estimate Std. Error Df t value Pr(>|t|)
(Intercept)   6.610     0.8987  4  7.3551  0.00182 **
B1             0.050     1.2710  4  0.0393  0.97050
B2             0.000     0.0000  4
B1:A1         -3.185     1.2710  4 -2.5060  0.06634 .
B1:A2          0.000     0.0000  4
B2:A1         -1.465     1.2710  4 -1.1527  0.31324
B2:A2          0.000     0.0000  4
A1             0.000     0.0000  4
A2             0.000     0.0000  4
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

(11) MODEL

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

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```

```

$Parameter
      Estimate Std. Error Df t value Pr(>|t|)
(Intercept)    6.610     0.8987  4  7.3551  0.00182 **
A1:B1          -3.135     1.2710  4 -2.4667  0.06920 .
A1:B2          -1.465     1.2710  4 -1.1527  0.31324
A2:B1           0.050     1.2710  4  0.0393  0.97050
A2:B2           0.000     0.0000  4
A1              0.000     0.0000  4
A2              0.000     0.0000  4
B1              0.000     0.0000  4
B2              0.000     0.0000  4
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

(12) MODEL

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

```

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

```

```

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

```

```

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

```

```

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

```



```

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

```

```

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

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

```

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

```

```

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

```

```

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

```

\$`Type III`

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

\$Parameter

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

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

4.2.2 p24

(14) MODEL

```
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	Std. Error	Df	t value	Pr(> t)
(Intercept)	10.290	1.11945	7	9.1920	3.718e-05 ***
A1	-2.305	0.91403	7	-2.5218	0.03971 *
A2	0.000	0.00000	7		
B1	-6.450	2.23891	7	-2.8809	0.02362 *
B2	-4.080	1.29263	7	-3.1563	0.01601 *
B3	-1.610	0.91403	7	-1.7614	0.12155
B4	0.000	0.00000	7		
C1	1.065	2.23891	7	0.4757	0.64879
C2	1.760	1.29263	7	1.3616	0.21553
C3	0.000	0.00000	7		
C4	0.000	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

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

\$ANOVA

Response : y

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

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

\$`Type I`

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

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

\$`Type II`

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

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

\$`Type III`

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

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	16.270	0.84809	6	19.1844	1.298e-06 ***
A1	-8.870	0.97929	6	-9.0576	0.0001015 ***
A2	-4.915	0.69246	6	-7.0979	0.0003927 ***
A3	0.000	0.00000	6		
B1	-4.900	0.69246	6	-7.0762	0.0003993 ***
B2	-1.875	0.97929	6	-1.9147	0.1040334
B3	0.000	0.00000	6		
A1:B1					
A1:B2	-0.460	1.19937	6	-0.3835	0.7145464
A1:B3	0.000	0.00000	6		
A2:B1	0.000	0.00000	6		
A2:B2					
A2:B3	0.000	0.00000	6		
A3:B1	0.000	0.00000	6		
A3:B2	0.000	0.00000	6		
A3:B3					

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

4.3.2 p33

(16) MODEL

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

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	4	34.905	8.7261		
RESIDUALS	0	0.000			
CORRECTED TOTAL	4	34.905			

\$`Type I`

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

\$`Type II`

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

\$`Type III`

CAUTION: Singularity Exists !

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

\$Parameter

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

A2:B2	0.00	0
A2:B3		
A3:B1		
A3:B2		
A3:B3	0.00	0

```
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

```
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

```
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

```
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

```

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

```

\$ANOVA

Response : fruitwt

```

              Df Sum Sq Mean Sq F value    Pr(>F)
MODEL          11 445334    40485   12.04 6.643e-08 ***
RESIDUALS       28  94147     3362
CORRECTED TOTAL 39 539481

```

```

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

```

\$`Type I`

```

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

```

```

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

```

```

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

```

```

$Parameter
      Estimate Std. Error Df t value  Pr(>|t|)
(Intercept)   220.150     31.760 28  6.9316 1.553e-07 ***
bloc1         152.600     36.674 28  4.1610 0.0002725 ***
bloc2         249.600     36.674 28  6.8060 2.155e-07 ***
bloc3          83.400     36.674 28  2.2741 0.0308206 *
bloc4        -112.000     36.674 28 -3.0540 0.0049132 **
bloc5         115.400     36.674 28  3.1467 0.0038956 **
bloc6         101.800     36.674 28  2.7758 0.0097029 **
bloc7          45.000     36.674 28  1.2270 0.2300251
bloc8           0.000         0.000 28
irrigbasin    -9.250     28.993 28 -0.3190 0.7520625
irrigflood   -70.000     28.993 28 -2.4144 0.0225461 *
irrigspray   -75.875     28.993 28 -2.6170 0.0141421 *
irrigsprnkler -7.625     28.993 28 -0.2630 0.7944806
irrigtrickle  0.000         0.000 28
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

5.2.2 p72

(24) MODEL

```

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

```

\$ANOVA

Response : wtloss

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	9	7076.5	786.28	12.837	0.002828 **
RESIDUALS	6	367.5	61.25		
CORRECTED TOTAL	15	7444.0			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
run	3	986.5	328.83	5.3687	0.0390130 *
pos	3	1468.5	489.50	7.9918	0.0161685 *
mat	3	4621.5	1540.50	25.1510	0.0008498 ***

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
run	3	986.5	328.83	5.3687	0.0390130 *
pos	3	1468.5	489.50	7.9918	0.0161685 *
mat	3	4621.5	1540.50	25.1510	0.0008498 ***

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
run	3	986.5	328.83	5.3687	0.0390130 *
pos	3	1468.5	489.50	7.9918	0.0161685 *
mat	3	4621.5	1540.50	25.1510	0.0008498 ***

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	210.25	6.1872	6	33.9815	4.325e-08 ***
run1	9.25	5.5340	6	1.6715	0.1456579
run2	7.00	5.5340	6	1.2649	0.2528101
run3	21.75	5.5340	6	3.9303	0.0077104 **
run4	0.00	0.0000	6		
pos1	8.50	5.5340	6	1.5360	0.1754542
pos2	26.25	5.5340	6	4.7434	0.0031802 **
pos3	8.25	5.5340	6	1.4908	0.1866076
pos4	0.00	0.0000	6		
matA	35.25	5.5340	6	6.3697	0.0007032 ***
matB	-10.50	5.5340	6	-1.8974	0.1065582
matC	11.25	5.5340	6	2.0329	0.0883093 .
matD	0.00	0.0000	6		

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

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

\$ANOVA

Response : shrink

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	9	265.75	29.528	9.8426	0.005775 **
RESIDUALS	6	18.00	3.000		
CORRECTED TOTAL	15	283.75			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
run	3	33.25	11.083	3.6944	0.081254 .
pos	3	60.25	20.083	6.6944	0.024212 *
mat	3	172.25	57.417	19.1389	0.001786 **

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
run	3	33.25	11.083	3.6944	0.081254 .
pos	3	60.25	20.083	6.6944	0.024212 *
mat	3	172.25	57.417	19.1389	0.001786 **

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
run	3	33.25	11.083	3.6944	0.081254 .
pos	3	60.25	20.083	6.6944	0.024212 *
mat	3	172.25	57.417	19.1389	0.001786 **

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	41.75	1.3693	6	30.4899	8.261e-08 ***
run1	0.50	1.2247	6	0.4082	0.697261
run2	1.25	1.2247	6	1.0206	0.346810
run3	3.75	1.2247	6	3.0619	0.022172 *
run4	0.00	0.0000	6		
pos1	2.75	1.2247	6	2.2454	0.065859 .
pos2	5.00	1.2247	6	4.0825	0.006484 **

```

pos3          0.75      1.2247  6  0.6124  0.562764
pos4          0.00      0.0000  6
matA          6.75      1.2247  6  5.5114  0.001499 **
matB         -2.00      1.2247  6 -1.6330  0.153590
matC          2.75      1.2247  6  2.2454  0.065859 .
matD          0.00      0.0000  6
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

5.2.3 p75

(25) MODEL

```

p75w = read.table("C:/G/Rt/SAS41m/p75.txt", header=TRUE)
p75l = reshape(p75w,
               direction = "long",
               varying = list(names(p75w)[4:9]),
               v.names = "Y",
               idvar = c("method", "variety", "trt"),
               timevar = "yield",
               times = 1:6)
p75l = af(p75l, c("variety", "yield"))
GLM(Y ~ method*variety, p75l) # p78

```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	14	1339.0	95.645	4.8674	2.723e-06 ***
RESIDUALS	75	1473.8	19.650		
CORRECTED TOTAL	89	2812.8			

```

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

```

\$`Type I`

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

```

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

```

\$`Type II`

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


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

```
$`Type III`
```

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

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

```
$Parameter
```

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	12.5500	1.8097	75	6.9348	1.23e-09 ***
methoda	9.7833	2.5593	75	3.8226	0.0002707 ***
methodb	6.6667	2.5593	75	2.6049	0.0110772 *
methodc	0.0000	0.0000	75		
variety1	5.8667	2.5593	75	2.2923	0.0246955 *
variety2	7.3667	2.5593	75	2.8784	0.0052049 **
variety3	4.7667	2.5593	75	1.8625	0.0664519 .
variety4	2.2833	2.5593	75	0.8922	0.3751569
variety5	0.0000	0.0000	75		
methoda:variety1	-6.4333	3.6194	75	-1.7775	0.0795479 .
methoda:variety2	-7.8500	3.6194	75	-2.1689	0.0332634 *
methoda:variety3	-3.9667	3.6194	75	-1.0959	0.2766108
methoda:variety4	1.3500	3.6194	75	0.3730	0.7102090
methoda:variety5	0.0000	0.0000	75		
methodb:variety1	-10.0000	3.6194	75	-2.7629	0.0072031 **
methodb:variety2	-11.3500	3.6194	75	-3.1359	0.0024473 **
methodb:variety3	-8.5333	3.6194	75	-2.3577	0.0210000 *
methodb:variety4	-8.0000	3.6194	75	-2.2103	0.0301340 *
methodb:variety5	0.0000	0.0000	75		
methodc:variety1	0.0000	0.0000	75		
methodc:variety2	0.0000	0.0000	75		
methodc:variety3	0.0000	0.0000	75		
methodc:variety4	0.0000	0.0000	75		
methodc:variety5	0.0000	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

```

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

```

\$ANOVA

Response : logct

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	59	50.463	0.85531	22.229	< 2.2e-16 ***
RESIDUALS	60	2.309	0.03848		
CORRECTED TOTAL	119	52.772			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
package	19	30.529	1.60680	41.760	< 2.2e-16 ***
package:sampleA	40	19.934	0.49836	12.952	< 2.2e-16 ***

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
package	19	30.529	1.60680	41.760	< 2.2e-16 ***
package:sampleA	40	19.934	0.49836	12.952	< 2.2e-16 ***

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
package	19	30.529	1.60680	41.760	< 2.2e-16 ***
package:sampleA	40	19.934	0.49836	12.952	< 2.2e-16 ***

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	4.0380	0.13870	60	29.1124	< 2.2e-16 ***

package1	-0.6942	0.19616	60	-3.5391	0.0007825	***
package2	-1.4062	0.19616	60	-7.1689	1.288e-09	***
package3	-0.8099	0.19616	60	-4.1290	0.0001143	***
package4	-0.4040	0.19616	60	-2.0595	0.0437975	*
package5	-1.3788	0.19616	60	-7.0292	2.231e-09	***
package6	-1.6673	0.19616	60	-8.4999	6.910e-12	***
package7	-0.2562	0.19616	60	-1.3063	0.1964519	
package8	-1.7274	0.19616	60	-8.8062	2.094e-12	***
package9	-1.0124	0.19616	60	-5.1611	2.924e-06	***
package10	-1.7144	0.19616	60	-8.7402	2.707e-12	***
package11	-0.9731	0.19616	60	-4.9609	6.100e-06	***
package12	-0.8359	0.19616	60	-4.2616	7.279e-05	***
package13	-0.7625	0.19616	60	-3.8873	0.0002560	***
package14	-1.5190	0.19616	60	-7.7440	1.340e-10	***
package15	-1.3985	0.19616	60	-7.1297	1.503e-09	***
package16	0.0540	0.19616	60	0.2751	0.7841687	
package17	-1.0624	0.19616	60	-5.4160	1.132e-06	***
package18	-1.4658	0.19616	60	-7.4729	3.896e-10	***
package19	-0.0892	0.19616	60	-0.4546	0.6510110	
package20	0.0000	0.00000	60			
package1:sampleA1	-0.5257	0.19616	60	-2.6800	0.0094902	**
package1:sampleA2	-1.0912	0.19616	60	-5.5631	6.503e-07	***
package1:sampleA3	0.0000	0.00000	60			
package2:sampleA1	0.7757	0.19616	60	3.9548	0.0002049	***
package2:sampleA2	0.9866	0.19616	60	5.0298	4.741e-06	***
package2:sampleA3	0.0000	0.00000	60			
package3:sampleA1	-0.3974	0.19616	60	-2.0262	0.0472007	*
package3:sampleA2	-0.2931	0.19616	60	-1.4940	0.1404174	
package3:sampleA3	0.0000	0.00000	60			
package4:sampleA1	-0.3198	0.19616	60	-1.6301	0.1083175	
package4:sampleA2	-1.6365	0.19616	60	-8.3426	1.278e-11	***
package4:sampleA3	0.0000	0.00000	60			
package5:sampleA1	0.8826	0.19616	60	4.4993	3.188e-05	***
package5:sampleA2	0.6156	0.19616	60	3.1382	0.0026355	**
package5:sampleA3	0.0000	0.00000	60			
package6:sampleA1	-0.7341	0.19616	60	-3.7422	0.0004105	***
package6:sampleA2	-0.4318	0.19616	60	-2.2011	0.0315906	*
package6:sampleA3	0.0000	0.00000	60			
package7:sampleA1	-0.5654	0.19616	60	-2.8825	0.0054684	**
package7:sampleA2	-0.0688	0.19616	60	-0.3508	0.7269701	
package7:sampleA3	0.0000	0.00000	60			
package8:sampleA1	-0.1137	0.19616	60	-0.5795	0.5644332	
package8:sampleA2	0.3757	0.19616	60	1.9153	0.0602278	.
package8:sampleA3	0.0000	0.00000	60			
package9:sampleA1	-0.2718	0.19616	60	-1.3854	0.1710573	
package9:sampleA2	-0.0803	0.19616	60	-0.4095	0.6836214	
package9:sampleA3	0.0000	0.00000	60			
package10:sampleA1	0.3684	0.19616	60	1.8779	0.0652619	.

```

package10:sampleA2 -0.5756    0.19616 60 -2.9345 0.0047275 **
package10:sampleA3  0.0000    0.00000 60
package11:sampleA1  0.3030    0.19616 60  1.5446 0.1277034
package11:sampleA2  0.3470    0.19616 60  1.7690 0.0819836 .
package11:sampleA3  0.0000    0.00000 60
package12:sampleA1  0.4875    0.19616 60  2.4851 0.0157584 *
package12:sampleA2  0.4577    0.19616 60  2.3333 0.0230013 *
package12:sampleA3  0.0000    0.00000 60
package13:sampleA1 -0.2737    0.19616 60 -1.3953 0.1680716
package13:sampleA2 -1.2309    0.19616 60 -6.2752 4.243e-08 ***
package13:sampleA3  0.0000    0.00000 60
package14:sampleA1  0.6523    0.19616 60  3.3256 0.0015089 **
package14:sampleA2  1.6004    0.19616 60  8.1590 2.625e-11 ***
package14:sampleA3  0.0000    0.00000 60
package15:sampleA1  0.8492    0.19616 60  4.3291 5.770e-05 ***
package15:sampleA2 -0.5446    0.19616 60 -2.7764 0.0073206 **
package15:sampleA3  0.0000    0.00000 60
package16:sampleA1  0.6186    0.19616 60  3.1538 0.0025178 **
package16:sampleA2 -0.1946    0.19616 60 -0.9923 0.3250282
package16:sampleA3  0.0000    0.00000 60
package17:sampleA1  0.3223    0.19616 60  1.6429 0.1056276
package17:sampleA2 -0.7938    0.19616 60 -4.0467 0.0001508 ***
package17:sampleA3  0.0000    0.00000 60
package18:sampleA1  0.9477    0.19616 60  4.8314 9.762e-06 ***
package18:sampleA2  0.1888    0.19616 60  0.9623 0.3397458
package18:sampleA3  0.0000    0.00000 60
package19:sampleA1 -0.1623    0.19616 60 -0.8273 0.4113450
package19:sampleA2 -0.8111    0.19616 60 -4.1352 0.0001120 ***
package19:sampleA3  0.0000    0.00000 60
package20:sampleA1 -1.0114    0.19616 60 -5.1560 2.980e-06 ***
package20:sampleA2 -0.5923    0.19616 60 -3.0197 0.0037126 **
package20:sampleA3  0.0000    0.00000 60
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

5.3.2 p116

(27) MODEL

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

\$ANOVA

Response : Y

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

CORRECTED TOTAL 89 2812.8

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

\$`Type I`

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

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

\$`Type II`

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

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

\$`Type III`

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

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	12.5500	1.8097	75	6.9348	1.23e-09 ***
methoda	9.7833	2.5593	75	3.8226	0.0002707 ***
methodb	6.6667	2.5593	75	2.6049	0.0110772 *
methodc	0.0000	0.0000	75		
variety1	5.8667	2.5593	75	2.2923	0.0246955 *
variety2	7.3667	2.5593	75	2.8784	0.0052049 **
variety3	4.7667	2.5593	75	1.8625	0.0664519 .
variety4	2.2833	2.5593	75	0.8922	0.3751569
variety5	0.0000	0.0000	75		
methoda:variety1	-6.4333	3.6194	75	-1.7775	0.0795479 .
methoda:variety2	-7.8500	3.6194	75	-2.1689	0.0332634 *
methoda:variety3	-3.9667	3.6194	75	-1.0959	0.2766108
methoda:variety4	1.3500	3.6194	75	0.3730	0.7102090
methoda:variety5	0.0000	0.0000	75		
methodb:variety1	-10.0000	3.6194	75	-2.7629	0.0072031 **
methodb:variety2	-11.3500	3.6194	75	-3.1359	0.0024473 **
methodb:variety3	-8.5333	3.6194	75	-2.3577	0.0210000 *
methodb:variety4	-8.0000	3.6194	75	-2.2103	0.0301340 *

```

methodb:variety5    0.0000    0.0000 75
methodc:variety1    0.0000    0.0000 75
methodc:variety2    0.0000    0.0000 75
methodc:variety3    0.0000    0.0000 75
methodc:variety4    0.0000    0.0000 75
methodc:variety5    0.0000    0.0000 75
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

5.3.3 p122

(28) MODEL

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```

```

et          3 3.1122 1.03739  9.3333 0.0002851 ***
et:wafer    8 4.2745 0.53431  4.8071 0.0012742 **
pos         3 1.1289 0.37630  3.3855 0.0345139 *
et:pos      9 0.8095 0.08994  0.8092 0.6125279

```

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	6.1775	0.23574	24	26.2044	< 2.2e-16 ***
et1	-0.8017	0.33339	24	-2.4046	0.024265 *
et2	-0.1792	0.33339	24	-0.5374	0.595934
et3	-0.0467	0.33339	24	-0.1400	0.889847
et4	0.0000	0.00000	24		
et1:wafer1	0.7025	0.23574	24	2.9799	0.006508 **
et1:wafer2	0.8300	0.23574	24	3.5208	0.001750 **
et1:wafer3	0.0000	0.00000	24		
et2:wafer1	-0.0800	0.23574	24	-0.3394	0.737295
et2:wafer2	-0.1650	0.23574	24	-0.6999	0.490709
et2:wafer3	0.0000	0.00000	24		
et3:wafer1	-0.5125	0.23574	24	-2.1740	0.039796 *
et3:wafer2	0.4000	0.23574	24	1.6968	0.102675
et3:wafer3	0.0000	0.00000	24		
et4:wafer1	0.6850	0.23574	24	2.9057	0.007755 **
et4:wafer2	0.4025	0.23574	24	1.7074	0.100660
et4:wafer3	0.0000	0.00000	24		
pos1	-0.2000	0.27221	24	-0.7347	0.469628
pos2	0.0133	0.27221	24	0.0490	0.961339
pos3	-0.6433	0.27221	24	-2.3634	0.026551 *
pos4	0.0000	0.00000	24		
et1:pos1	-0.0733	0.38497	24	-0.1905	0.850525
et1:pos2	-0.4500	0.38497	24	-1.1689	0.253910
et1:pos3	0.3100	0.38497	24	0.8053	0.428573
et1:pos4	0.0000	0.00000	24		
et2:pos1	0.2767	0.38497	24	0.7187	0.479279
et2:pos2	0.2567	0.38497	24	0.6667	0.511307
et2:pos3	0.4933	0.38497	24	1.2815	0.212262
et2:pos4	0.0000	0.00000	24		
et3:pos1	0.2433	0.38497	24	0.6321	0.533304
et3:pos2	0.2400	0.38497	24	0.6234	0.538882
et3:pos3	0.3233	0.38497	24	0.8399	0.409254
et3:pos4	0.0000	0.00000	24		
et4:pos1	0.0000	0.00000	24		
et4:pos2	0.0000	0.00000	24		
et4:pos3	0.0000	0.00000	24		
et4:pos4	0.0000	0.00000	24		

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

5.3.4 p136

(29) MODEL

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

\$ANOVA

Response : drywt

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	11	157.208	14.2917	20.26	4.594e-06 ***
RESIDUALS	12	8.465	0.7054		
CORRECTED TOTAL	23	165.673			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	3	25.320	8.440	11.9646	0.0006428 ***
cult	1	2.407	2.407	3.4117	0.0895283 .
rep:cult	3	9.480	3.160	4.4796	0.0249095 *
inoc	2	118.176	59.088	83.7631	8.919e-08 ***
cult:inoc	2	1.826	0.913	1.2942	0.3097837

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	3	25.320	8.440	11.9646	0.0006428 ***
cult	1	2.407	2.407	3.4117	0.0895283 .
rep:cult	3	9.480	3.160	4.4796	0.0249095 *
inoc	2	118.176	59.088	83.7631	8.919e-08 ***
cult:inoc	2	1.826	0.913	1.2942	0.3097837

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	3	25.320	8.440	11.9646	0.0006428 ***
cult	1	2.407	2.407	3.4117	0.0895283 .
rep:cult	3	9.480	3.160	4.4796	0.0249095 *
inoc	2	118.176	59.088	83.7631	8.919e-08 ***
cult:inoc	2	1.826	0.913	1.2942	0.3097837

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


```

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

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

(31) MODEL

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

\$ANOVA

Response : FLUSH

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TRT	1	20.5	20.49	0.0653	0.79906
STUDY	4	3599.4	899.85	2.8688	0.02956 *
TRT:STUDY	4	473.8	118.45	0.3776	0.82383

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TRT	1	66.0	66.04	0.2105	0.64783
STUDY	4	3599.4	899.85	2.8688	0.02956 *
TRT:STUDY	4	473.8	118.45	0.3776	0.82383

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TRT	1	1.9	1.93	0.0062	0.9377
STUDY	4	3339.4	834.85	2.6616	0.0400 *
TRT:STUDY	4	473.8	118.45	0.3776	0.8238

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	24.2321	6.6940	67	3.6200	0.0005671 ***
TRTA	-9.5030	9.8532	67	-0.9645	0.3382875
TRTB	0.0000	0.0000	67		
STUDY42	4.1012	18.9334	67	0.2166	0.8291705
STUDY43	0.3108	8.1984	67	0.0379	0.9698723
STUDY44	-12.8822	9.8532	67	-1.3074	0.1955439
STUDY45	4.1451	8.5629	67	0.4841	0.6299091
STUDY46	0.0000	0.0000	67		
TRTA:STUDY42	24.4078	23.8240	67	1.0245	0.3092815
TRTA:STUDY43	6.6743	11.9120	67	0.5603	0.5771416
TRTA:STUDY44	6.9476	14.5635	67	0.4771	0.6348740
TRTA:STUDY45	11.6841	12.4143	67	0.9412	0.3499931
TRTA:STUDY46	0.0000	0.0000	67		
TRTB:STUDY42	0.0000	0.0000	67		
TRTB:STUDY43	0.0000	0.0000	67		
TRTB:STUDY44	0.0000	0.0000	67		
TRTB:STUDY45	0.0000	0.0000	67		
TRTB:STUDY46	0.0000	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

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

\$ANOVA

Response : score2

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

\$`Type I`

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

\$`Type II`

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

\$`Type III`

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	72.455	2.0097	28	36.0530	<2e-16 ***
teachJAY	3.545	3.3828	28	1.0481	0.3036
teachPAT	0.903	2.6855	28	0.3361	0.7393
teachROBIN	0.000	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	Std. Error	Df	t value	Pr(> t)
(Intercept)	5.4000	0.65912	12	8.1927	2.944e-06 ***
a1	-4.4000	1.61452	12	-2.7253	0.018427 *
a2	0.0000	0.00000	12		
b1	-2.9000	1.23311	12	-2.3518	0.036594 *
b2	2.9333	1.07634	12	2.7253	0.018427 *
b3	0.0000	0.00000	12		
a1:b1	7.4000	2.18607	12	3.3851	0.005417 **
a1:b2	0.6667	1.94041	12	0.3436	0.737114
a1:b3	0.0000	0.00000	12		
a2:b1	0.0000	0.00000	12		
a2:b2	0.0000	0.00000	12		
a2:b3	0.0000	0.00000	12		

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

5.5.3 p203

(34) MODEL

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

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	4	45.816	11.4539	5.2729	0.01097 *
RESIDUALS	12	26.067	2.1722		
CORRECTED TOTAL	16	71.882			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
a	1	2.9252	2.9252	1.3466	0.268432
b	2	13.3224	6.6612	3.0665	0.083997 .
a:b	1	29.5681	29.5681	13.6119	0.003095 **

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
a	1	5.5652	5.5652	2.5620	0.135442
b	2	13.3224	6.6612	3.0665	0.083997 .
a:b	1	29.5681	29.5681	13.6119	0.003095 **

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
a	1	0.3507	0.3507	0.1615	0.694881
b	2	16.0733	8.0367	3.6997	0.056021 .
a:b	1	29.5681	29.5681	13.6119	0.003095 **

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	5.4000	0.65912	12	8.1927	2.944e-06 ***
a1	-3.7333	1.07634	12	-3.4685	0.004644 **
a2	0.0000	0.00000	12		
b1	-2.9000	1.23311	12	-2.3518	0.036594 *
b2	2.9333	1.07634	12	2.7253	0.018427 *
b3	0.0000	0.00000	12		

```

a1:b1          6.7333      1.82503 12  3.6894  0.003095 **
a1:b2          0.0000      0.00000 12
a1:b3
a2:b1          0.0000      0.00000 12
a2:b2          0.0000      0.00000 12
a2:b3          0.0000      0.00000 12
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

5.5.4 p215

(35) MODEL

```

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

```

\$ANOVA

Response : yield

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

\$`Type I`

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

\$`Type II`

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

\$`Type III`

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	30.6667	2.5609	6	11.9750	2.055e-05 ***
irrig1	2.6333	3.6216	6	0.7271	0.4945
irrig2	3.5833	3.6216	6	0.9894	0.3607
irrig3	0.0000	0.0000	6		
irrig1:reps1	-4.9000	3.1364	6	-1.5623	0.1692
irrig1:reps2	-1.5000	3.1364	6	-0.4783	0.6494
irrig1:reps3	0.0000	0.0000	6		
irrig2:reps1	-5.6000	3.1364	6	-1.7855	0.1244
irrig2:reps2	-3.3500	3.1364	6	-1.0681	0.3266
irrig2:reps3	0.0000	0.0000	6		
irrig3:reps1	-1.7000	3.1364	6	-0.5420	0.6073
irrig3:reps2	-0.8000	3.1364	6	-0.2551	0.8072
irrig3:reps3	0.0000	0.0000	6		
cultA	0.3667	2.5609	6	0.1432	0.8908
cultB	0.0000	0.0000	6		
irrig1:cultA	-0.0667	3.6216	6	-0.0184	0.9859
irrig1:cultB	0.0000	0.0000	6		
irrig2:cultA	-0.0667	3.6216	6	-0.0184	0.9859
irrig2:cultB	0.0000	0.0000	6		
irrig3:cultA	0.0000	0.0000	6		
irrig3:cultB	0.0000	0.0000	6		

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

Compare with SAS output

(36) MODEL

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

\$ANOVA

Response : yield

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

\$`Type I`

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

\$`Type II`

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

\$`Type III`

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

\$Parameter

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

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

\$ANOVA

Response : final

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	9	355.84	39.537	139.51	2.572e-09 ***
RESIDUALS	10	2.83	0.283		
CORRECTED TOTAL	19	358.67			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
initial	1	342.36	342.36	1208.0336	9.211e-12 ***
trt	4	12.09	3.02	10.6645	0.001247 **
initial:trt	4	1.39	0.35	1.2247	0.360175

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
initial	1	156.040	156.040	550.5987	4.478e-10 ***
trt	4	12.089	3.022	10.6645	0.001247 **
initial:trt	4	1.388	0.347	1.2247	0.360175

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
initial	1	68.529	68.529	241.8091	2.472e-08 ***
trt	4	1.696	0.424	1.4963	0.2752
initial:trt	4	1.388	0.347	1.2247	0.3602

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	-0.4318	2.1328	10	-0.2025	0.8436
initial	1.2239	0.1017	10	12.0298	2.854e-07 ***

```

trt1          5.6731      3.5715 10  1.5884      0.1433
trt2         -8.7175      8.9578 10 -0.9732      0.3534
trt3          5.2498      3.4875 10  1.5053      0.1632
trt4          4.7276      2.9399 10  1.6081      0.1389
trt5          0.0000      0.0000 10
initial:trt1  -0.2412      0.1398 10 -1.7256      0.1151
initial:trt2   0.2775      0.3358 10  0.8263      0.4279
initial:trt3  -0.1678      0.1509 10 -1.1123      0.2920
initial:trt4  -0.1670      0.1269 10 -1.3153      0.2178
initial:trt5   0.0000      0.0000 10
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

5.6.3 p241

(39) MODEL

```

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

```

\$ANOVA

Response : Q1

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

```

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

```

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
P1	1	516.59	516.59	23.7444	5.739e-05 ***
DAY	5	430.54	86.11	3.9578	0.009275 **
P1:DAY	5	164.39	32.88	1.5112	0.223566

```

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

```

\$`Type II`

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

```

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

```

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

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

5.6.4 p243

(40) MODEL

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

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

```
$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
DAY     5  250.40   50.079   2.3018 0.0764717 .
DAY:P1  6  861.13  143.521   6.5967 0.0003239 ***
```

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

```
$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
DAY      5 250.40  50.079   2.3018 0.0764717 .
DAY:P1    6 861.13 143.521   6.5967 0.0003239 ***
```

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

```
$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
DAY      5 201.17  40.234   1.8493 0.1411648
DAY:P1    6 861.13 143.521   6.5967 0.0003239 ***
```

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

```
$Parameter
      Estimate Std. Error Df t value  Pr(>|t|)
(Intercept)  73.273     13.4837 24  5.4341 1.39e-05 ***
DAY1         -54.597     19.7355 24 -2.7664 0.0107321 *
DAY2         -34.786     20.2511 24 -1.7177 0.0987253 .
DAY3         -27.943     29.4284 24 -0.9495 0.3518193
DAY4         -24.123     21.3933 24 -1.1276 0.2706307
DAY5           4.626     30.6284 24  0.1510 0.8812016
DAY6           0.000      0.0000 24
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
```

```
REG(Q1 ~ DAY + DAY:P1 - 1, p241) # Output 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

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

\$ANOVA

Response : Q1

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

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
P1	1	516.59	516.59	23.7444	5.739e-05 ***
DAY	5	430.54	86.11	3.9578	0.009275 **
P1:DAY	5	164.39	32.88	1.5112	0.223566

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

\$`Type II`

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

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

\$`Type III`

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

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	73.273	13.4837	24	5.4341	1.39e-05 ***
P1	-1.225	0.2652	24	-4.6199	0.0001092 ***

DAY1	-54.597	19.7355	24	-2.7664	0.0107321	*
DAY2	-34.786	20.2511	24	-1.7177	0.0987253	.
DAY3	-27.943	29.4284	24	-0.9495	0.3518193	
DAY4	-24.123	21.3933	24	-1.1276	0.2706307	
DAY5	4.626	30.6284	24	0.1510	0.8812016	
DAY6	0.000	0.0000	24			
P1:DAY1	1.005	0.3941	24	2.5494	0.0175983	*
P1:DAY2	0.602	0.3988	24	1.5088	0.1444129	
P1:DAY3	0.614	0.5703	24	1.0768	0.2922646	
P1:DAY4	0.430	0.4151	24	1.0349	0.3110314	
P1:DAY5	0.029	0.5703	24	0.0515	0.9593643	
P1:DAY6	0.000	0.0000	24			

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

(42) MODEL

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

\$ANOVA

Response : Q1

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	12	1225.37	102.114	5.7521	0.0001688 ***
RESIDUALS	23	408.31	17.753		
CORRECTED TOTAL	35	1633.68			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
STORE	5	313.42	62.68	3.5310	0.01629 *
DAY	5	250.40	50.08	2.8210	0.03957 *
P1	1	622.01	622.01	35.0377	4.924e-06 ***
P2	1	39.54	39.54	2.2274	0.14917

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
STORE	5	223.83	44.77	2.5217	0.058346 .
DAY	5	433.10	86.62	4.8793	0.003456 **
P1	1	538.17	538.17	30.3150	1.342e-05 ***
P2	1	39.54	39.54	2.2274	0.149171

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
STORE	5	223.83	44.77	2.5217	0.058346 .
DAY	5	433.10	86.62	4.8793	0.003456 **
P1	1	538.17	538.17	30.3150	1.342e-05 ***
P2	1	39.54	39.54	2.2274	0.149171

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	51.700	9.7910	23	5.2803	2.333e-05 ***
STORE1	-7.645	2.6919	23	-2.8401	0.009273 **
STORE2	-5.602	2.4642	23	-2.2735	0.032650 *
STORE3	-7.363	2.4642	23	-2.9880	0.006573 **
STORE4	-4.365	2.4875	23	-1.7547	0.092620 .
STORE5	-5.021	2.4361	23	-2.0609	0.050799 .
STORE6	0.000	0.0000	23		
DAY1	-5.830	2.5193	23	-2.3143	0.029934 *
DAY2	-4.900	2.4471	23	-2.0024	0.057172 .
DAY3	2.270	2.5403	23	0.8935	0.380834
DAY4	-2.652	2.4467	23	-1.0841	0.289545
DAY5	4.047	2.5566	23	1.5830	0.127078
DAY6	0.000	0.0000	23		
P1	-0.830	0.1508	23	-5.5059	1.342e-05 ***
P2	0.149	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

```
p250 = read.table("C:/G/Rt/SAS41m/p250.txt", header=TRUE)
p250 = af(p250, c("variety", "spacing", "plant"))
GLM(lint ~ bollwt + variety + spacing + variety:spacing + variety:spacing:plant,
     p250) # p252 Output 7.18, Parameter is different due to different order
```

\$ANOVA

Response : lint

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

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
bollwt	1	29.0693	29.0693	602.3107	< 2.2e-16 ***
variety	1	1.2635	1.2635	26.1802	8.158e-06 ***
spacing	1	0.4666	0.4666	9.6689	0.003447 **
variety:spacing	1	0.0933	0.0933	1.9325	0.172169
variety:spacing:plant	4	0.2673	0.0668	1.3847	0.256548

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
bollwt	1	11.1186	11.1186	230.3745	< 2.2e-16 ***
variety	1	1.1973	1.1973	24.8084	1.259e-05 ***
spacing	1	0.4666	0.4666	9.6689	0.003447 **
variety:spacing	1	0.0933	0.0933	1.9325	0.172169
variety:spacing:plant	4	0.2673	0.0668	1.3847	0.256548

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
bollwt	1	11.1186	11.1186	230.3745	< 2.2e-16 ***
variety	1	0.9424	0.9424	19.5269	7.379e-05 ***
spacing	1	0.3748	0.3748	7.7666	0.008101 **
variety:spacing	1	0.0479	0.0479	0.9915	0.325350
variety:spacing:plant	4	0.2673	0.0668	1.3847	0.256548

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	-0.27244	0.119340	40	-2.2829	0.027825 *
bollwt	0.30561	0.020135	40	15.1781	< 2.2e-16 ***
variety37	0.42327	0.129645	40	3.2649	0.002249 **
variety213	0.00000	0.000000	40		
spacing30	0.03796	0.151615	40	0.2504	0.803596
spacing40	0.00000	0.000000	40		
variety37:spacing30	0.02364	0.198980	40	0.1188	0.906004
variety37:spacing40	0.00000	0.000000	40		
variety213:spacing30	0.00000	0.000000	40		
variety213:spacing40	0.00000	0.000000	40		
variety37:spacing30:plant0					
variety37:spacing30:plant3	0.08923	0.150334	40	0.5935	0.556164
variety37:spacing30:plant5	0.00000	0.000000	40		
variety37:spacing40:plant0					
variety37:spacing40:plant3	-0.02713	0.110857	40	-0.2447	0.807910
variety37:spacing40:plant5	0.00000	0.000000	40		

```

variety213:spacing30:plant0
variety213:spacing30:plant3 0.33372 0.160556 40 2.0785 0.044120 *
variety213:spacing30:plant5 0.00000 0.000000 40
variety213:spacing40:plant0 -0.09849 0.111519 40 -0.8832 0.382418
variety213:spacing40:plant3 0.00000 0.000000 40
variety213:spacing40:plant5
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

5.6.6 p254 Output 7.20

(44) MODEL

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

```

$ANOVA
Response : lint

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

```

```

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

```

```

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

```

```

$`Type III`
              Df Sum Sq Mean Sq F value    Pr(>F)
bollwt        1 11.5717 11.5717 227.2815 < 2.2e-16 ***
variety        1  1.1973  1.1973  23.5168 1.516e-05 ***
spacing        1  0.4666  0.4666   9.1655 0.004072 **
---

```

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	-0.27695	0.103845	45	-2.6670	0.010598 *
bolllwt	0.30144	0.019995	45	15.0759	< 2.2e-16 ***
variety37	0.41066	0.084682	45	4.8494	1.516e-05 ***
variety213	0.00000	0.000000	45		
spacing30	0.20521	0.067782	45	3.0275	0.004072 **
spacing40	0.00000	0.000000	45		

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

5.6.7 p256

(45) MODEL

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

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	8	816.50	102.063	6.0641	0.0014 **
RESIDUALS	15	252.46	16.831		
CORRECTED TOTAL	23	1068.96			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
bloc	3	538.79	179.597	10.6709	0.0005223 ***
type	1	12.04	12.042	0.7155	0.4109264
logdose	2	121.58	60.792	3.6120	0.0524231 .
type:logdose	2	144.08	72.042	4.2804	0.0338265 *

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
bloc	3	538.79	179.597	10.6709	0.0005223 ***
type	1	12.04	12.042	0.7155	0.4109264
logdose	2	121.58	60.792	3.6120	0.0524231 .
type:logdose	2	144.08	72.042	4.2804	0.0338265 *

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
bloc	3	538.79	179.597	10.6709	0.0005223 ***
type	1	12.04	12.042	0.7155	0.4109264
logdose	2	121.58	60.792	3.6120	0.0524231 .
type:logdose	2	144.08	72.042	4.2804	0.0338265 *

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	62.042	2.5123	15	24.6955	1.457e-13 ***
bloc1	7.667	2.3686	15	3.2368	0.005531 **
bloc2	-3.500	2.3686	15	-1.4777	0.160183
bloc3	-4.333	2.3686	15	-1.8295	0.087270 .
bloc4	0.000	0.0000	15		
type1	-8.000	2.9009	15	-2.7578	0.014656 *
type2	0.000	0.0000	15		
logdose0	-11.250	2.9009	15	-3.8781	0.001486 **
logdose1	-7.750	2.9009	15	-2.6716	0.017423 *
logdose2	0.000	0.0000	15		
type1:logdose0	11.750	4.1025	15	2.8641	0.011824 *
type1:logdose1	8.000	4.1025	15	1.9500	0.070117 .
type1:logdose2	0.000	0.0000	15		
type2:logdose0	0.000	0.0000	15		
type2:logdose1	0.000	0.0000	15		
type2:logdose2	0.000	0.0000	15		

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

5.6.8 p261 Output 7.27

(46) MODEL

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

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	8	816.50	102.063	6.0641	0.0014 **
RESIDUALS	15	252.46	16.831		
CORRECTED TOTAL	23	1068.96			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
bloc	3	538.79	179.597	10.6709	0.0005223 ***
type	1	12.04	12.042	0.7155	0.4109264
logdose	1	115.56	115.562	6.8662	0.0193005 *
logd2	1	6.02	6.021	0.3577	0.5586917
type:logdose	1	138.06	138.062	8.2031	0.0118242 *
type:logd2	1	6.02	6.021	0.3577	0.5586917

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
bloc	3	538.79	179.597	10.6709	0.0005223 ***
type	1	12.04	12.042	0.7155	0.4109264
logdose	1	0.39	0.389	0.0231	0.8811262
logd2	1	6.02	6.021	0.3577	0.5586917
type:logdose	1	0.81	0.812	0.0483	0.8290541
type:logd2	1	6.02	6.021	0.3577	0.5586917

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
bloc	3	538.79	179.597	10.6709	0.0005223 ***
type	1	28.12	28.125	1.6711	0.2156736
logdose	1	0.39	0.389	0.0231	0.8811262
logd2	1	6.02	6.021	0.3577	0.5586917
type:logdose	1	0.81	0.812	0.0483	0.8290541
type:logd2	1	6.02	6.021	0.3577	0.5586917

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

\$Parameter

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

```

type2:logdose      0.000      0.0000 15
type1:logd2       -2.125      3.5529 15 -0.5981  0.558692
type2:logd2        0.000      0.0000 15
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

5.6.9 p262 Output 7.28

(47) MODEL

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

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	8	816.50	102.063	6.0641	0.0014 **
RESIDUALS	15	252.46	16.831		
CORRECTED TOTAL	23	1068.96			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
bloc	3	538.79	179.597	10.6709	0.0005223 ***
type	1	12.04	12.042	0.7155	0.4109264
type:logdose	4	265.67	66.417	3.9462	0.0220552 *

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
bloc	3	538.79	179.597	10.6709	0.0005223 ***
type	1	12.04	12.042	0.7155	0.4109264
type:logdose	4	265.67	66.417	3.9462	0.0220552 *

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
bloc	3	538.79	179.597	10.6709	0.0005223 ***
type	1	12.04	12.042	0.7155	0.4109264
type:logdose	4	265.67	66.417	3.9462	0.0220552 *

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	62.042	2.5123	15	24.6955	1.457e-13 ***
bloc1	7.667	2.3686	15	3.2368	0.005531 **
bloc2	-3.500	2.3686	15	-1.4777	0.160183
bloc3	-4.333	2.3686	15	-1.8295	0.087270 .
bloc4	0.000	0.0000	15		
type1	-8.000	2.9009	15	-2.7578	0.014656 *
type2	0.000	0.0000	15		
type1:logdose0	0.500	2.9009	15	0.1724	0.865459
type1:logdose1	0.250	2.9009	15	0.0862	0.932463
type1:logdose2	0.000	0.0000	15		
type2:logdose0	-11.250	2.9009	15	-3.8781	0.001486 **
type2:logdose1	-7.750	2.9009	15	-2.6716	0.017423 *
type2:logdose2	0.000	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

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

\$ANOVA

Response : fev1

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	92	296.65	3.2244	51.078	< 2.2e-16 ***
RESIDUALS	483	30.49	0.0631		
CORRECTED TOTAL	575	327.14			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
drug	2	25.783	12.8913	204.212	< 2.2e-16 ***
drug:patient	69	247.412	3.5857	56.801	< 2.2e-16 ***
hour	7	17.170	2.4529	38.857	< 2.2e-16 ***
drug:hour	14	6.280	0.4486	7.106	1.923e-13 ***

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
drug	2	25.783	12.8913	204.212	< 2.2e-16 ***
drug:patient	69	247.412	3.5857	56.801	< 2.2e-16 ***
hour	7	17.170	2.4529	38.857	< 2.2e-16 ***
drug:hour	14	6.280	0.4486	7.106	1.923e-13 ***

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
drug	2	25.783	12.8913	204.212	< 2.2e-16 ***
drug:patient	69	247.412	3.5857	56.801	< 2.2e-16 ***
hour	7	17.170	2.4529	38.857	< 2.2e-16 ***
drug:hour	14	6.280	0.4486	7.106	1.923e-13 ***

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

\$Parameter

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

drugc:patient202	-0.42250	0.12562	483	-3.3632	0.0008318	***
drugc:patient203	-1.53375	0.12562	483	-12.2089	< 2.2e-16	***
drugc:patient204	-0.21000	0.12562	483	-1.6716	0.0952434	.
drugc:patient205	0.32375	0.12562	483	2.5771	0.0102586	*
drugc:patient206	0.11750	0.12562	483	0.9353	0.3500901	
drugc:patient207	-1.72750	0.12562	483	-13.7512	< 2.2e-16	***
drugc:patient208	-0.43625	0.12562	483	-3.4726	0.0005617	***
drugc:patient209	-0.25500	0.12562	483	-2.0298	0.0429198	*
drugc:patient210	-1.08250	0.12562	483	-8.6169	< 2.2e-16	***
drugc:patient211	-0.74500	0.12562	483	-5.9303	5.765e-09	***
drugc:patient212	-1.72375	0.12562	483	-13.7214	< 2.2e-16	***
drugc:patient214	-0.68625	0.12562	483	-5.4627	7.522e-08	***
drugc:patient215	0.09875	0.12562	483	0.7861	0.4322131	
drugc:patient216	0.05375	0.12562	483	0.4279	0.6689439	
drugc:patient217	-1.91875	0.12562	483	-15.2736	< 2.2e-16	***
drugc:patient218	-0.78250	0.12562	483	-6.2288	1.023e-09	***
drugc:patient219	-0.84875	0.12562	483	-6.7562	4.087e-11	***
drugc:patient220	-1.01000	0.12562	483	-8.0398	7.105e-15	***
drugc:patient221	0.23250	0.12562	483	1.8507	0.0648170	.
drugc:patient222	-0.60625	0.12562	483	-4.8259	1.873e-06	***
drugc:patient223	0.96000	0.12562	483	7.6418	1.164e-13	***
drugc:patient224	0.22750	0.12562	483	1.8109	0.0707711	.
drugc:patient232	0.00000	0.00000	483			
drugp:patient201	-0.63250	0.12562	483	-5.0348	6.764e-07	***
drugp:patient202	-0.04500	0.12562	483	-0.3582	0.7203440	
drugp:patient203	-1.27250	0.12562	483	-10.1293	< 2.2e-16	***
drugp:patient204	0.34750	0.12562	483	2.7662	0.0058894	**
drugp:patient205	0.60625	0.12562	483	4.8259	1.873e-06	***
drugp:patient206	0.11500	0.12562	483	0.9154	0.3604275	
drugp:patient207	-0.55875	0.12562	483	-4.4478	1.078e-05	***
drugp:patient208	-0.57000	0.12562	483	-4.5373	7.199e-06	***
drugp:patient209	0.35000	0.12562	483	2.7861	0.0055451	**
drugp:patient210	-0.36875	0.12562	483	-2.9353	0.0034909	**
drugp:patient211	-0.26375	0.12562	483	-2.0995	0.0362913	*
drugp:patient212	-1.18000	0.12562	483	-9.3930	< 2.2e-16	***
drugp:patient214	-0.30625	0.12562	483	-2.4378	0.0151363	*
drugp:patient215	-0.06250	0.12562	483	-0.4975	0.6190549	
drugp:patient216	0.24000	0.12562	483	1.9104	0.0566680	.
drugp:patient217	-1.80375	0.12562	483	-14.3582	< 2.2e-16	***
drugp:patient218	-0.28750	0.12562	483	-2.2886	0.0225363	*
drugp:patient219	-0.14375	0.12562	483	-1.1443	0.2530759	
drugp:patient220	-0.21125	0.12562	483	-1.6816	0.0932951	.
drugp:patient221	0.78375	0.12562	483	6.2388	9.646e-10	***
drugp:patient222	-0.06500	0.12562	483	-0.5174	0.6051056	
drugp:patient223	0.38000	0.12562	483	3.0249	0.0026199	**
drugp:patient224	0.79500	0.12562	483	6.3283	5.662e-10	***
drugp:patient232	0.00000	0.00000	483			
hour1	0.09458	0.07253	483	1.3041	0.1928336	

hour2	0.16042	0.07253	483	2.2117	0.0274523	*
hour3	0.16583	0.07253	483	2.2864	0.0226619	*
hour4	0.13917	0.07253	483	1.9188	0.0556048	.
hour5	0.03625	0.07253	483	0.4998	0.6174473	
hour6	0.08333	0.07253	483	1.1490	0.2511439	
hour7	0.05250	0.07253	483	0.7238	0.4695140	
hour8	0.00000	0.00000	483			
druga:hour1	0.52083	0.10257	483	5.0777	5.464e-07	***
druga:hour2	0.37833	0.10257	483	3.6884	0.0002513	***
druga:hour3	0.16000	0.10257	483	1.5599	0.1194454	
druga:hour4	0.04917	0.10257	483	0.4793	0.6319171	
druga:hour5	0.15917	0.10257	483	1.5517	0.1213779	
druga:hour6	0.03792	0.10257	483	0.3697	0.7118002	
druga:hour7	-0.04208	0.10257	483	-0.4103	0.6817836	
druga:hour8	0.00000	0.00000	483			
drugc:hour1	0.58625	0.10257	483	5.7155	1.917e-08	***
drugc:hour2	0.45583	0.10257	483	4.4440	1.096e-05	***
drugc:hour3	0.40125	0.10257	483	3.9119	0.0001047	***
drugc:hour4	0.29417	0.10257	483	2.8679	0.0043130	**
drugc:hour5	0.20292	0.10257	483	1.9783	0.0484656	*
drugc:hour6	-0.00833	0.10257	483	-0.0812	0.9352821	
drugc:hour7	-0.08583	0.10257	483	-0.8368	0.4031156	
drugc:hour8	0.00000	0.00000	483			
drugp:hour1	0.00000	0.00000	483			
drugp:hour2	0.00000	0.00000	483			
drugp:hour3	0.00000	0.00000	483			
drugp:hour4	0.00000	0.00000	483			
drugp:hour5	0.00000	0.00000	483			
drugp:hour6	0.00000	0.00000	483			
drugp:hour7	0.00000	0.00000	483			
drugp:hour8	0.00000	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

```
p390 = read.table("C:/G/Rt/SAS4lm/p390.txt", header=TRUE)
p390$ca = ifelse(p390$a == 0, -1, 1)
p390$cb = ifelse(p390$b == 0, -1, 1)
p390$cc = ifelse(p390$c == 0, -1, 1)
p390 = af(p390, c("rep", "blk", "a", "b", "c"))
GLM(y ~ rep/blk + ca*cb*cc, p390)
```

\$ANOVA

Response : y

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

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

\$`Type I`

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

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

\$`Type II`

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

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

\$`Type III`

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

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	2.01062	0.25171	11	7.9879	6.627e-06 ***
rep1	0.32813	0.35597	11	0.9218	0.376420
rep2	-0.11000	0.35597	11	-0.3090	0.763085
rep3	0.00000	0.00000	11		
rep1:blk1	0.20000	0.38995	11	0.5129	0.618170
rep1:blk2	0.00000	0.00000	11		
rep2:blk1	0.87375	0.38995	11	2.2407	0.046645 *
rep2:blk2	0.00000	0.00000	11		
rep3:blk1	0.66875	0.38995	11	1.7150	0.114346
rep3:blk2	0.00000	0.00000	11		
ca	0.93708	0.09191	11	10.1955	6.090e-07 ***
cb	0.01375	0.09191	11	0.1496	0.883787
ca:cb	-0.26792	0.09191	11	-2.9149	0.014064 *
cc	1.25458	0.09191	11	13.6499	3.063e-08 ***
ca:cc	0.38062	0.11257	11	3.3813	0.006129 **
cb:cc	-0.84188	0.11257	11	-7.4788	1.232e-05 ***
ca:cb:cc	-0.04375	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

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

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	7	6.3559	0.90798		
RESIDUALS	0	0.0000			
CORRECTED TOTAL	7	6.3559			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
ca	1	2.07061	2.07061		
cb	1	0.59951	0.59951		
ca:cb	1	0.00031	0.00031		
cc	1	0.00551	0.00551		

ca:cc	1	0.80011	0.80011
cb:cc	1	2.82031	2.82031
ca:cb:cc	1	0.05951	0.05951
cd	0		
ca:cd	0		
cb:cd	0		
ca:cb:cd	0		
cc:cd	0		
ca:cc:cd	0		
cb:cc:cd	0		
ca:cb:cc:cd	0		

\$`Type II`

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

\$`Type III`

CAUTION: Singularity Exists !

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

```

$Parameter
      Estimate Std. Error 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	Std. Error	Df	t value	Pr(> t)
(Intercept)	3.63		0		
a0	-0.20		0		
a1	0.00		0		
b0	-1.55		0		
b1	0.00		0		
a0:b0	-0.37		0		
a0:b1	0.00		0		

a1:b0	0.00	0
a1:b1	0.00	0
c0	-0.33	0
c1	0.00	0
a0:c0	-1.61	0
a0:c1	0.00	0
a1:c0	0.00	0
a1:c1	0.00	0
b0:c0	2.03	0
b0:c1	0.00	0
b1:c0	0.00	0
b1:c1	0.00	0
a0:b0:c0	0.69	0
a0:b0:c1	0.00	0
a0:b1:c0	0.00	0
a0:b1:c1	0.00	0
a1:b0:c0	0.00	0
a1:b0:c1	0.00	0
a1:b1:c0	0.00	0
a1:b1:c1	0.00	0
d0	0.00	0
d1	0.00	0
a0:d0	0.00	0
a0:d1	0.00	0
a1:d0	0.00	0
a1:d1	0.00	0
b0:d0	0.00	0
b0:d1	0.00	0
b1:d0	0.00	0
b1:d1	0.00	0
a0:b0:d0	0.00	0
a0:b0:d1	0.00	0
a0:b1:d0	0.00	0
a0:b1:d1	0.00	0
a1:b0:d0	0.00	0
a1:b0:d1	0.00	0
a1:b1:d0	0.00	0
a1:b1:d1	0.00	0
c0:d0	0.00	0
c0:d1	0.00	0
c1:d0	0.00	0
c1:d1	0.00	0
a0:c0:d0	0.00	0
a0:c0:d1	0.00	0
a0:c1:d0	0.00	0
a0:c1:d1	0.00	0
a1:c0:d0	0.00	0
a1:c0:d1	0.00	0

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

5.8.3 p399

(52) MODEL

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

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	8	281.127	35.141	40.822	0.005606 **
RESIDUALS	3	2.583	0.861		
CORRECTED TOTAL	11	283.710			

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

\$`Type I`

Df	Sum Sq	Mean Sq	F value	Pr(>F)
----	--------	---------	---------	--------

```
trt  3 102.26  34.086  39.596 0.006515 **
blk  5 178.87  35.774  41.558 0.005691 **
---
```

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

\$`Type II`

```
      Df Sum Sq Mean Sq F value    Pr(>F)
trt   3   59.018   19.673   22.853 0.014388 *
blk   5  178.871   35.774   41.558 0.005691 **
---
```

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

\$`Type III`

```
      Df Sum Sq Mean Sq F value    Pr(>F)
trt   3   59.017   19.672   22.853 0.014388 *
blk   5  178.871   35.774   41.558 0.005691 **
---
```

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

\$Parameter

```
      Estimate Std. Error Df    t value    Pr(>|t|)
(Intercept)  19.1375     1.03732  3  18.4489 0.0003475 ***
trt1         -6.8250     0.92781  3   -7.3560 0.0051925 **
trt2         -5.9750     0.92781  3   -6.4399 0.0075922 **
trt3         -2.7000     0.92781  3   -2.9101 0.0619928 .
trt4          0.0000     0.00000  3
blk1        -10.7875     1.03732  3  -10.3994 0.0018975 **
blk2         -9.9375     1.03732  3   -9.5799 0.0024133 **
blk3         -5.9750     1.03732  3   -5.7600 0.0103986 *
blk4         -4.2000     1.03732  3   -4.0489 0.0271308 *
blk5         -2.1750     1.13633  3   -1.9141 0.1515206
blk6          0.0000     0.00000  3
---
```

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

5.8.4 p403

(53) MODEL

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

\$ANOVA

Response : HR

```
      Df Sum Sq Mean Sq F value    Pr(>F)
```

```

MODEL          29 6408.7  220.99   3.912 3.127e-05 ***
RESIDUALS      42 2372.6   56.49
CORRECTED TOTAL 71 8781.3

```

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
SEQUENCE	5	508.9	101.79	1.8019	0.133346
SEQUENCE:PATIENT	18	4692.3	260.69	4.6147	2.21e-05 ***
VISIT	2	146.8	73.39	1.2991	0.283499
DRUG	2	668.8	334.39	5.9194	0.005435 **
RESIDS	1	391.0	391.02	6.9219	0.011854 *
RESIDT	1	0.8	0.84	0.0149	0.903511

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

\$`Type II`

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

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

\$`Type III`

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

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	88.000	4.7287	42	18.6097	< 2.2e-16 ***
SEQUENCEA	6.208	6.2319	42	0.9962	0.3248514
SEQUENCEB	-19.333	6.1368	42	-3.1504	0.0030025 **
SEQUENCEC	-0.479	6.2319	42	-0.0769	0.9390770
SEQUENCED	-1.813	6.2319	42	-0.2908	0.7726044
SEQUENCEE	-5.792	6.2319	42	-0.9294	0.3580166
SEQUENCEF	0.000	0.0000	42		

SEQUENCEA: PATIENT1					
SEQUENCEA: PATIENT2					
SEQUENCEA: PATIENT3					
SEQUENCEA: PATIENT4					
SEQUENCEA: PATIENT5					
SEQUENCEA: PATIENT6					
SEQUENCEA: PATIENT7	-4.000	6.1368	42	-0.6518	0.5180764
SEQUENCEA: PATIENT8	-29.333	6.1368	42	-4.7799	2.168e-05 ***
SEQUENCEA: PATIENT9					
SEQUENCEA: PATIENT10					
SEQUENCEA: PATIENT11					
SEQUENCEA: PATIENT12					
SEQUENCEA: PATIENT13					
SEQUENCEA: PATIENT14					
SEQUENCEA: PATIENT15	-13.333	6.1368	42	-2.1727	0.0354954 *
SEQUENCEA: PATIENT16					
SEQUENCEA: PATIENT17	0.000	0.0000	42		
SEQUENCEA: PATIENT18					
SEQUENCEA: PATIENT19					
SEQUENCEA: PATIENT20					
SEQUENCEA: PATIENT21					
SEQUENCEA: PATIENT22					
SEQUENCEA: PATIENT23					
SEQUENCEA: PATIENT24					
SEQUENCEB: PATIENT1	24.000	6.1368	42	3.9108	0.0003299 ***
SEQUENCEB: PATIENT2					
SEQUENCEB: PATIENT3	17.333	6.1368	42	2.8245	0.0072135 **
SEQUENCEB: PATIENT4					
SEQUENCEB: PATIENT5					
SEQUENCEB: PATIENT6	13.333	6.1368	42	2.1727	0.0354954 *
SEQUENCEB: PATIENT7					
SEQUENCEB: PATIENT8					
SEQUENCEB: PATIENT9					
SEQUENCEB: PATIENT10					
SEQUENCEB: PATIENT11					
SEQUENCEB: PATIENT12					
SEQUENCEB: PATIENT13					
SEQUENCEB: PATIENT14					
SEQUENCEB: PATIENT15					
SEQUENCEB: PATIENT16					
SEQUENCEB: PATIENT17					
SEQUENCEB: PATIENT18					
SEQUENCEB: PATIENT19					
SEQUENCEB: PATIENT20	0.000	0.0000	42		
SEQUENCEB: PATIENT21					
SEQUENCEB: PATIENT22					
SEQUENCEB: PATIENT23					
SEQUENCEB: PATIENT24					

SEQUENCEC:PATIENT1					
SEQUENCEC:PATIENT2					
SEQUENCEC:PATIENT3					
SEQUENCEC:PATIENT4					
SEQUENCEC:PATIENT5	-13.333	6.1368	42	-2.1727	0.0354954 *
SEQUENCEC:PATIENT6					
SEQUENCEC:PATIENT7					
SEQUENCEC:PATIENT8					
SEQUENCEC:PATIENT9					
SEQUENCEC:PATIENT10	-10.667	6.1368	42	-1.7382	0.0895112 .
SEQUENCEC:PATIENT11					
SEQUENCEC:PATIENT12					
SEQUENCEC:PATIENT13					
SEQUENCEC:PATIENT14					
SEQUENCEC:PATIENT15					
SEQUENCEC:PATIENT16					
SEQUENCEC:PATIENT17					
SEQUENCEC:PATIENT18					
SEQUENCEC:PATIENT19					
SEQUENCEC:PATIENT20					
SEQUENCEC:PATIENT21	9.333	6.1368	42	1.5209	0.1357823
SEQUENCEC:PATIENT22	0.000	0.0000	42		
SEQUENCEC:PATIENT23					
SEQUENCEC:PATIENT24					
SEQUENCED:PATIENT1					
SEQUENCED:PATIENT2					
SEQUENCED:PATIENT3					
SEQUENCED:PATIENT4	6.000	6.1368	42	0.9777	0.3338152
SEQUENCED:PATIENT5					
SEQUENCED:PATIENT6					
SEQUENCED:PATIENT7					
SEQUENCED:PATIENT8					
SEQUENCED:PATIENT9	7.333	6.1368	42	1.1950	0.2387989
SEQUENCED:PATIENT10					
SEQUENCED:PATIENT11					
SEQUENCED:PATIENT12					
SEQUENCED:PATIENT13	0.667	6.1368	42	0.1086	0.9140096
SEQUENCED:PATIENT14					
SEQUENCED:PATIENT15					
SEQUENCED:PATIENT16					
SEQUENCED:PATIENT17					
SEQUENCED:PATIENT18					
SEQUENCED:PATIENT19					
SEQUENCED:PATIENT20					
SEQUENCED:PATIENT21					
SEQUENCED:PATIENT22					
SEQUENCED:PATIENT23					
SEQUENCED:PATIENT24	0.000	0.0000	42		

SEQUENCEE: PATIENT1					
SEQUENCEE: PATIENT2					
SEQUENCEE: PATIENT3					
SEQUENCEE: PATIENT4					
SEQUENCEE: PATIENT5					
SEQUENCEE: PATIENT6					
SEQUENCEE: PATIENT7					
SEQUENCEE: PATIENT8					
SEQUENCEE: PATIENT9					
SEQUENCEE: PATIENT10					
SEQUENCEE: PATIENT11					
SEQUENCEE: PATIENT12	12.000	6.1368	42	1.9554	0.0572081 .
SEQUENCEE: PATIENT13					
SEQUENCEE: PATIENT14					
SEQUENCEE: PATIENT15					
SEQUENCEE: PATIENT16	13.333	6.1368	42	2.1727	0.0354954 *
SEQUENCEE: PATIENT17					
SEQUENCEE: PATIENT18					
SEQUENCEE: PATIENT19	-0.667	6.1368	42	-0.1086	0.9140096
SEQUENCEE: PATIENT20					
SEQUENCEE: PATIENT21					
SEQUENCEE: PATIENT22					
SEQUENCEE: PATIENT23	0.000	0.0000	42		
SEQUENCEE: PATIENT24					
SEQUENCEF: PATIENT1					
SEQUENCEF: PATIENT2	-18.667	6.1368	42	-3.0418	0.0040426 **
SEQUENCEF: PATIENT3					
SEQUENCEF: PATIENT4					
SEQUENCEF: PATIENT5					
SEQUENCEF: PATIENT6					
SEQUENCEF: PATIENT7					
SEQUENCEF: PATIENT8					
SEQUENCEF: PATIENT9					
SEQUENCEF: PATIENT10					
SEQUENCEF: PATIENT11	-8.000	6.1368	42	-1.3036	0.1994653
SEQUENCEF: PATIENT12					
SEQUENCEF: PATIENT13					
SEQUENCEF: PATIENT14	-2.000	6.1368	42	-0.3259	0.7461154
SEQUENCEF: PATIENT15					
SEQUENCEF: PATIENT16					
SEQUENCEF: PATIENT17					
SEQUENCEF: PATIENT18	0.000	0.0000	42		
SEQUENCEF: PATIENT19					
SEQUENCEF: PATIENT20					
SEQUENCEF: PATIENT21					
SEQUENCEF: PATIENT22					
SEQUENCEF: PATIENT23					
SEQUENCEF: PATIENT24					

VISIT2	-2.583	2.1697	42	-1.1907	0.2404762
VISIT3	0.750	2.1697	42	0.3457	0.7313138
VISIT4	0.000	0.0000	42		
DRUGplacebo	-5.938	2.4258	42	-2.4477	0.0186398 *
DRUGstandard	-3.625	2.4258	42	-1.4944	0.1425553
DRUGtest	0.000	0.0000	42		
RESIDS	-4.396	1.8790	42	-2.3395	0.0241414 *
RESIDT	0.229	1.8790	42	0.1220	0.9035106

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

```
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

```
p409 = read.table("C:/G/Rt/SAS41m/p409.txt", header=TRUE)
GLM(TS ~ SOURCE*AMT, p409) # p410 Output 11.21
```

\$ANOVA

Response : TS

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	5	258.727	51.745	263.71	1.785e-09 ***
RESIDUALS	9	1.766	0.196		
CORRECTED TOTAL	14	260.493			


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

```
$`Type I`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
SOURCE	2	98.001	49.001	249.720	1.306e-08 ***
AMT	1	138.245	138.245	704.534	7.392e-10 ***
SOURCE:AMT	2	22.481	11.240	57.284	7.595e-06 ***

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

```
$`Type II`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
SOURCE	2	98.001	49.001	249.720	1.306e-08 ***
AMT	1	138.245	138.245	704.534	7.392e-10 ***
SOURCE:AMT	2	22.481	11.240	57.284	7.595e-06 ***

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

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
SOURCE	2	0.070	0.035	0.179	0.839
AMT	1	138.245	138.245	704.534	7.392e-10 ***
SOURCE:AMT	2	22.481	11.240	57.284	7.595e-06 ***

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

```
$Parameter
```

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	9.49	0.46459	9	20.4266	7.537e-09 ***
SOURCEA	0.33	0.65703	9	0.5023	0.6275
SOURCEB	-0.02	0.65703	9	-0.0304	0.9764
SOURCEC	0.00	0.00000	9		
AMT	3.35	0.14008	9	23.9150	1.867e-09 ***
SOURCEA:AMT	-1.61	0.19810	9	-8.1271	1.951e-05 ***
SOURCEB:AMT	-2.00	0.19810	9	-10.0958	3.305e-06 ***
SOURCEC:AMT	0.00	0.00000	9		

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

5.8.6 p412

(55) MODEL

```
p412 = read.table("C:/G/Rt/SAS41m/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

```

p414 = read.table("C:/G/Rt/SAS41m/p414.txt", header=TRUE)
p414 = af(p414, c("lackofit"))
GLM(loglivcu ~ level + lackofit, p414) # p415 Output 11.26

```

```

$ANOVA
Response : loglivcu

```

```

              Df Sum Sq Mean Sq F value    Pr(>F)
MODEL              3 5.2310  1.74365   155.47 5.018e-14 ***
RESIDUALS          20 0.2243  0.01122
CORRECTED TOTAL  23 5.4553
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
              Df Sum Sq Mean Sq F value    Pr(>F)
level          1 4.9859  4.9859 444.555 3.997e-15 ***
lackofit       2 0.2450  0.1225  10.924 0.0006216 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
              Df Sum Sq Mean Sq F value    Pr(>F)
level          0
lackofit       2 0.24504 0.12252  10.924 0.0006216 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
CAUTION: Singularity Exists !
              Df Sum Sq Mean Sq F value    Pr(>F)
level          0
lackofit       2 0.24504 0.12252  10.924 0.0006216 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
              Estimate Std. Error Df t value  Pr(>|t|)
(Intercept)  1.41347    0.155886 20  9.0674 1.598e-08 ***
level         0.00210    0.000408 20  5.1443 4.937e-05 ***
lackofit0    -0.19544    0.161770 20 -1.2081  0.241091
lackofit150  -0.34501    0.105903 20 -3.2578  0.003939 **
lackofit300   0.00000    0.000000 20
lackofit450   0.00000    0.000000 20
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

5.8.8 p417

(57) MODEL

```

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

```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	7	267.226	38.175	12.433	7.522e-05 ***
RESIDUALS	13	39.917	3.071		
CORRECTED TOTAL	20	307.143			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TRT	2	236.921	118.460	38.580	3.412e-06 ***
TRT:POT	5	30.306	6.061	1.974	0.1499

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TRT	2	236.921	118.460	38.580	3.412e-06 ***
TRT:POT	5	30.306	6.061	1.974	0.1499

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TRT	2	200.111	100.055	32.586	8.626e-06 ***
TRT:POT	5	30.306	6.061	1.974	0.1499

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	12.0000	0.78365	13	15.3130	1.070e-09 ***
TRT1	0.0000	1.91954	13	0.0000	1.00000
TRT2	8.2500	1.17547	13	7.0185	9.087e-06 ***
TRT3	0.0000	0.00000	13		
TRT1:POT1	2.6667	2.02337	13	1.3179	0.21028
TRT1:POT2	6.0000	2.14611	13	2.7958	0.01515 *
TRT1:POT3	0.0000	0.00000	13		
TRT2:POT1	0.2500	1.51753	13	0.1647	0.87168
TRT2:POT2	0.0000	0.00000	13		
TRT2:POT3					
TRT3:POT1	1.0000	1.27969	13	0.7814	0.44854
TRT3:POT2	-1.0000	1.91954	13	-0.5210	0.61115
TRT3:POT3	0.0000	0.00000	13		

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

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

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

Anova Table (Type III tests)

Response: Y

	Sum Sq	Df	F values	Pr(>F)
TRT	22.310	1	7.266	0.01835 *
TRT:POT	30.306	5	1.974	0.14991
Residuals	39.917	13		

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

5.8.9 p431

(58) MODEL

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

\$ANOVA

Response : avdlygn

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	16	2.5275	0.157966	3.1437	0.001091 **
RESIDUALS	48	2.4119	0.050248		
CORRECTED TOTAL	64	4.9394			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
line	2	0.38009	0.190046	3.7821	0.02983 *
line:sire	6	0.92634	0.154391	3.0726	0.01260 *
agedam	2	0.11894	0.059471	1.1835	0.31497
line:agedam	4	0.64889	0.162222	3.2284	0.02000 *
age	1	0.18349	0.183487	3.6516	0.06200 .
intlwt	1	0.26970	0.269704	5.3674	0.02483 *

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
line	2	0.05526	0.02763	0.5498	0.580636	
line:sire	6	0.97389	0.16231	3.2303	0.009543	**
agedam	2	0.33106	0.16553	3.2943	0.045640	*
line:agedam	4	0.45343	0.11336	2.2560	0.076821	.
age	1	0.38128	0.38128	7.5878	0.008277	**
intlwt	1	0.26970	0.26970	5.3674	0.024830	*

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
line	2	0.13620	0.06810	1.3553	0.267560	
line:sire	6	0.97389	0.16231	3.2303	0.009543	**
agedam	2	0.13011	0.06505	1.2946	0.283392	
line:agedam	4	0.45343	0.11336	2.2560	0.076821	.
age	1	0.38128	0.38128	7.5878	0.008277	**
intlwt	1	0.26970	0.26970	5.3674	0.024830	*

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)	
(Intercept)	2.99627	0.51285	48	5.8423	4.361e-07	***
line1	0.07182	0.14551	48	0.4936	0.623826	
line2	0.25247	0.13717	48	1.8406	0.071867	.
line3	0.00000	0.00000	48			
line1:sire1	0.08573	0.13028	48	0.6580	0.513652	
line1:sire2	-0.12171	0.13622	48	-0.8934	0.376079	
line1:sire3	0.00000	0.00000	48			
line1:sire4						
line1:sire5						
line1:sire6						
line1:sire7						
line1:sire8						
line1:sire9						
line2:sire1						
line2:sire2						
line2:sire3						
line2:sire4	-0.24460	0.12669	48	-1.9307	0.059443	.
line2:sire5	0.00000	0.00000	48			
line2:sire6						
line2:sire7						
line2:sire8						
line2:sire9						
line3:sire1						
line3:sire2						
line3:sire3						

```

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

```

p433 Output 11.40

```

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

```

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

Anova Table (Type III tests)

```

Response: avdlygn
      Sum Sq Df F values    Pr(>F)
line      0.00000  0
agedam    0.13011  2   1.2946 0.283392
age       0.38128  1   7.5878 0.008277 **
intlwt    0.26970  1   5.3674 0.024830 *
line:sire  0.97389  6   3.2303 0.009543 **
line:agedam 0.45343  4   2.2560 0.076821 .
Residuals 2.41192 48
---

```

```

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

```

(59) MODEL

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

```
$ANOVA
```

```
Response : avdlygn
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	10	1.4254	0.142538	2.1904	0.03237 *
RESIDUALS	54	3.5140	0.065074		
CORRECTED TOTAL	64	4.9394			

```
---
```

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

```
$`Type I`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
sire	8	1.30644	0.163305	2.5095	0.02138 *
agedam	2	0.11894	0.059471	0.9139	0.40707

```
---
```

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

```
$`Type II`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
sire	8	1.33017	0.166271	2.5551	0.01937 *
agedam	2	0.11894	0.059471	0.9139	0.40707

```
---
```

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

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
sire	8	1.33017	0.166271	2.5551	0.01937 *
agedam	2	0.11894	0.059471	0.9139	0.40707

```
---
```

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

```
$Parameter
```

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	2.46347	0.096216	54	25.6036	< 2e-16 ***
sire1	-0.00739	0.128186	54	-0.0576	0.95427
sire2	-0.21429	0.128606	54	-1.6662	0.10146
sire3	-0.02260	0.146050	54	-0.1548	0.87759
sire4	-0.02364	0.128186	54	-0.1844	0.85440
sire5	0.12311	0.132193	54	0.9313	0.35585
sire6	-0.05290	0.138320	54	-0.3824	0.70364
sire7	-0.14760	0.129061	54	-1.1436	0.25782
sire8	-0.40781	0.135054	54	-3.0196	0.00386 **
sire9	0.00000	0.000000	54		
agedam3	0.11738	0.089117	54	1.3172	0.19334
agedam4	0.04830	0.077154	54	0.6260	0.53395
agedam5	0.00000	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 Std. Error Df t value Pr(>|t|)
(Intercept)  2.99627    0.51285 48  5.8423 4.361e-07 ***
line1         0.07182    0.14551 48  0.4936 0.623826
line2         0.25247    0.13717 48  1.8406 0.071867 .
line3         0.00000    0.00000 48
sire1         0.08573    0.13028 48  0.6580 0.513652
sire2        -0.12171    0.13622 48 -0.8934 0.376079
sire3         0.00000    0.00000 48
sire4        -0.24460    0.12669 48 -1.9307 0.059443 .
sire5         0.00000    0.00000 48
sire6         0.10540    0.12909 48  0.8165 0.418267
sire7        -0.01952    0.12038 48 -0.1622 0.871856
sire8        -0.33024    0.12567 48 -2.6278 0.011504 *
sire9         0.00000    0.00000 48
agedam3       0.37039    0.11456 48  3.2332 0.002216 **
agedam4       0.27546    0.10378 48  2.6544 0.010746 *
agedam5       0.00000    0.00000 48
line1:agedam3 -0.44894    0.19581 48 -2.2927 0.026291 *
line1:agedam4 -0.28283    0.16085 48 -1.7584 0.085062 .
line1:agedam5  0.00000    0.00000 48
line2:agedam3 -0.26078    0.19529 48 -1.3354 0.188050
line2:agedam4 -0.35026    0.17439 48 -2.0085 0.050232 .
line2:agedam5  0.00000    0.00000 48
line3:agedam3  0.00000    0.00000 48
line3:agedam4  0.00000    0.00000 48
line3:agedam5  0.00000    0.00000 48
age          -0.00853    0.00310 48 -2.7546 0.008277 **
intlwt       0.00203    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	Std. Error	Df	t value	Pr(> t)
(Intercept)	66.133	0.47304	59	139.8040	< 2.2e-16 ***
Group1	-2.952	0.72726	59	-4.0584	0.0001473 ***

```

Group2      -2.508      0.80208 59  -3.1273 0.0027390 **
Group3      -1.967      0.88498 59  -2.2223 0.0301120 *
Group4      -2.592      0.60301 59  -4.2979 6.547e-05 ***
Group5       0.000      0.00000 59

```

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

6.2 Table 12.6

(62) MODEL

```

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

```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	7	1.6144	0.230636	8.9562	7.223e-07 ***
RESIDUALS	45	1.1588	0.025752		
CORRECTED TOTAL	52	2.7733			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Location	3	0.74036	0.24679	9.5833	5.219e-05 ***
Family	4	0.87410	0.21852	8.4859	3.436e-05 ***

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Location	3	0.83765	0.27921	10.8426	1.753e-05 ***
Family	4	0.87410	0.21852	8.4859	3.436e-05 ***

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Location	3	0.83765	0.27921	10.8426	1.753e-05 ***
Family	4	0.87410	0.21852	8.4859	3.436e-05 ***

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

```

$Parameter
      Estimate Std. Error Df t value Pr(>|t|)
(Intercept)  0.42999    0.079313 45  5.4214 2.236e-06 ***
Location1    0.27409    0.066143 45  4.1438 0.0001487 ***
Location2    0.07118    0.065245 45  1.0910 0.2810986
Location3   -0.06869    0.061950 45 -1.1088 0.2734048
Location4    0.00000    0.000000 45
Family1      0.18733    0.077778 45  2.4085 0.0201753 *
Family2     -0.02753    0.079595 45 -0.3458 0.7310768
Family3      0.31264    0.079951 45  3.9103 0.0003080 ***
Family4      0.14331    0.093203 45  1.5376 0.1311397
Family5      0.00000    0.000000 45
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

6.3 Table 13.6

(63) MODEL

```

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

```

```

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

```

```

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

```

```

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

```

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

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Site	2	804.83	402.42	101.026	2.887e-15 ***
Worker	3	430.88	143.63	36.058	8.310e-11 ***
Site:Worker	6	962.29	160.38	40.264	2.720e-14 ***

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

```
$Parameter
```

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	78.560	0.89256	35	88.0168	< 2.2e-16 ***
Site1	6.340	1.26227	35	5.0227	1.498e-05 ***
Site2	2.460	1.26227	35	1.9489	0.059362 .
Site3	0.000	0.00000	35		
Worker1	3.640	1.45754	35	2.4974	0.017365 *
Worker2	3.840	1.26227	35	3.0421	0.004433 **
Worker3	15.565	1.33883	35	11.6258	1.430e-13 ***
Worker4	0.000	0.00000	35		
Site1:Worker1	-5.940	2.62762	35	-2.2606	0.030108 *
Site1:Worker2	9.720	1.78511	35	5.4450	4.165e-06 ***
Site1:Worker3	-9.690	1.89340	35	-5.1178	1.124e-05 ***
Site1:Worker4	0.000	0.00000	35		
Site2:Worker1	-11.960	2.62762	35	-4.5517	6.165e-05 ***
Site2:Worker2	-12.960	1.84005	35	-7.0433	3.360e-08 ***
Site2:Worker3	-16.365	1.84005	35	-8.8938	1.660e-10 ***
Site2:Worker4	0.000	0.00000	35		
Site3:Worker1	0.000	0.00000	35		
Site3:Worker2	0.000	0.00000	35		
Site3:Worker3	0.000	0.00000	35		
Site3:Worker4	0.000	0.00000	35		

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

6.4 Table 14.2

(64) MODEL

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

```
$ANOVA
```

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	7	6345.4	906.48	8.1297	5.931e-08 ***
RESIDUALS	110	12265.3	111.50		
CORRECTED TOTAL	117	18610.6			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Day	2	3737.8	1868.90	16.7611	4.426e-07 ***
Machine	2	2440.7	1220.33	10.9445	4.625e-05 ***
Operator	3	166.9	55.63	0.4989	0.6838

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Day	2	3795.1	1897.56	17.0181	3.636e-07 ***
Machine	2	2464.8	1232.39	11.0526	4.227e-05 ***
Operator	3	166.9	55.63	0.4989	0.6838

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Day	2	3795.1	1897.56	17.0181	3.636e-07 ***
Machine	2	2464.8	1232.39	11.0526	4.227e-05 ***
Operator	3	166.9	55.63	0.4989	0.6838

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	194.520	2.8292	110	68.7541	< 2.2e-16 ***
Day1	-1.395	2.5210	110	-0.5535	0.5811
Day2	-12.591	2.4293	110	-5.1831	9.994e-07 ***
Day3	0.000	0.0000	110		
Machine1	10.446	2.4410	110	4.2795	4.015e-05 ***
Machine2	1.301	2.3888	110	0.5447	0.5871
Machine3	0.000	0.0000	110		
Operator1	-3.048	2.8546	110	-1.0677	0.2880
Operator2	-0.076	2.6570	110	-0.0287	0.9771
Operator3	-0.275	2.7474	110	-0.0999	0.9206
Operator4	0.000	0.0000	110		

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

6.5 Table 15.3

(65) MODEL

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

\$ANOVA

Response : pH

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	36	0.25804	0.0071678	2.8977	7.2e-06 ***
RESIDUALS	123	0.30425	0.0024736		
CORRECTED TOTAL	159	0.56229			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Dam	14	0.178017	0.0127155	5.1405	1.563e-07 ***
Dam:Sire	22	0.080024	0.0036374	1.4705	0.09662 .

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Dam	14	0.178017	0.0127155	5.1405	1.563e-07 ***
Dam:Sire	22	0.080024	0.0036374	1.4705	0.09662 .

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Dam	14	0.179405	0.0128146	5.1805	1.347e-07 ***
Dam:Sire	22	0.080024	0.0036374	1.4705	0.09662 .

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	7.5020	0.022242	123	337.2849	< 2.2e-16 ***
Dam1	-0.0445	0.033363	123	-1.3338	0.1847360
Dam2	-0.0670	0.033363	123	-2.0082	0.0468144 *
Dam3	-0.0600	0.031455	123	-1.9075	0.0587923 .
Dam4	-0.1170	0.033363	123	-3.5068	0.0006338 ***
Dam5	0.0513	0.036322	123	1.4133	0.1600927

Dam6	-0.0420	0.031455	123	-1.3352	0.1842689	
Dam7	-0.0580	0.031455	123	-1.8439	0.0676071	.
Dam8	-0.0440	0.031455	123	-1.3988	0.1643876	
Dam9	-0.0895	0.033363	123	-2.6826	0.0083104	**
Dam10	-0.0545	0.033363	123	-1.6335	0.1049163	
Dam11	-0.0140	0.031455	123	-0.4451	0.6570480	
Dam12	-0.0870	0.033363	123	-2.6076	0.0102452	*
Dam13	-0.0495	0.033363	123	-1.4837	0.1404576	
Dam14	-0.0340	0.031455	123	-1.0809	0.2818582	
Dam15	0.0000	0.000000	123			
Dam1:Sire1	0.0475	0.035168	123	1.3507	0.1792866	
Dam1:Sire2	0.0000	0.000000	123			
Dam1:Sire3						
Dam2:Sire1	-0.0010	0.033363	123	-0.0300	0.9761373	
Dam2:Sire2	0.0000	0.000000	123			
Dam2:Sire3						
Dam3:Sire1	-0.0045	0.033363	123	-0.1349	0.8929288	
Dam3:Sire2	-0.0320	0.033363	123	-0.9591	0.3393736	
Dam3:Sire3	0.0000	0.000000	123			
Dam4:Sire1	0.0550	0.037986	123	1.4479	0.1501886	
Dam4:Sire2	0.0000	0.000000	123			
Dam4:Sire3						
Dam5:Sire1	-0.0593	0.036322	123	-1.6336	0.1049091	
Dam5:Sire2	-0.0608	0.037986	123	-1.6015	0.1118387	
Dam5:Sire3	0.0000	0.000000	123			
Dam6:Sire1	-0.0450	0.033363	123	-1.3488	0.1798857	
Dam6:Sire2	0.0075	0.033363	123	0.2248	0.8225105	
Dam6:Sire3	0.0000	0.000000	123			
Dam7:Sire1	-0.0290	0.033363	123	-0.8692	0.3864232	
Dam7:Sire2	-0.0340	0.031455	123	-1.0809	0.2818582	
Dam7:Sire3	0.0000	0.000000	123			
Dam8:Sire1	0.0520	0.036322	123	1.4317	0.1547783	
Dam8:Sire2	0.0000	0.000000	123			
Dam8:Sire3						
Dam9:Sire1	-0.0225	0.035168	123	-0.6398	0.5235039	
Dam9:Sire2	0.0000	0.000000	123			
Dam9:Sire3						
Dam10:Sire1	-0.0695	0.033363	123	-2.0831	0.0393121	*
Dam10:Sire2	0.0000	0.000000	123			
Dam10:Sire3						
Dam11:Sire1	0.0460	0.031455	123	1.4624	0.1461852	
Dam11:Sire2	0.0000	0.000000	123			
Dam11:Sire3						
Dam12:Sire1	0.0470	0.033363	123	1.4087	0.1614391	
Dam12:Sire2	0.0000	0.000000	123			
Dam12:Sire3						
Dam13:Sire1	-0.0645	0.033363	123	-1.9333	0.0555032	.
Dam13:Sire2	-0.0358	0.037986	123	-0.9433	0.3473613	

```

Dam13:Sire3    0.0000    0.000000 123
Dam14:Sire1    0.0245    0.033363 123    0.7343 0.4641417
Dam14:Sire2   -0.0180    0.033363 123   -0.5395 0.5905089
Dam14:Sire3    0.0000    0.000000 123
Dam15:Sire1   -0.0500    0.031455 123   -1.5896 0.1145028
Dam15:Sire2   -0.0580    0.031455 123   -1.8439 0.0676071 .
Dam15:Sire3    0.0000    0.000000 123
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

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

```

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

Anova Table (Type III tests)

```

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

```

6.6 Table 16.3

(66) MODEL

```

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

```

```

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

$`Type I`

```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Plot	10	1.84041	0.184041	18.3332	1.929e-08 ***
Plot:Sample	22	0.99175	0.045079	4.4906	0.0004209 ***
Plot:Sample:Subsample	22	0.35757	0.016253	1.6191	0.1330632

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Plot	10	1.84041	0.184041	18.3332	1.929e-08 ***
Plot:Sample	22	0.99175	0.045079	4.4906	0.0004209 ***
Plot:Sample:Subsample	22	0.35757	0.016253	1.6191	0.1330632

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Plot	10	1.78686	0.178686	17.7998	2.547e-08 ***
Plot:Sample	22	0.99175	0.045079	4.4906	0.0004209 ***
Plot:Sample:Subsample	22	0.35757	0.016253	1.6191	0.1330632

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	0.390	0.10019	22	3.8925	0.0007836 ***
Plot1	0.130	0.14169	22	0.9175	0.3688465
Plot2	0.690	0.14169	22	4.8696	7.227e-05 ***
Plot3	-0.100	0.14169	22	-0.7057	0.4877535
Plot4	-0.290	0.14169	22	-2.0467	0.0528230 .
Plot5	0.530	0.14169	22	3.7404	0.0011335 **
Plot6	0.020	0.14169	22	0.1411	0.8890368
Plot7	0.050	0.14169	22	0.3529	0.7275426
Plot8	-0.030	0.14169	22	-0.2117	0.8342720
Plot9	0.530	0.14169	22	3.7404	0.0011335 **
Plot10	0.130	0.14169	22	0.9175	0.3688465
Plot11	0.000	0.00000	22		
Plot1:Sample1	-0.060	0.12271	22	-0.4890	0.6297131
Plot1:Sample2	0.020	0.14169	22	0.1411	0.8890368
Plot1:Sample3	0.000	0.00000	22		
Plot2:Sample1	-0.595	0.12271	22	-4.8488	7.603e-05 ***
Plot2:Sample2	-0.650	0.14169	22	-4.5873	0.0001437 ***
Plot2:Sample3	0.000	0.00000	22		
Plot3:Sample1	0.095	0.12271	22	0.7742	0.4470663
Plot3:Sample2	0.090	0.14169	22	0.6352	0.5318688
Plot3:Sample3	0.000	0.00000	22		
Plot4:Sample1	0.200	0.12271	22	1.6298	0.1173694
Plot4:Sample2	0.150	0.14169	22	1.0586	0.3012597

Plot4:Sample3	0.000	0.00000	22			
Plot5:Sample1	-0.365	0.12271	22	-2.9745	0.0069960	**
Plot5:Sample2	-0.080	0.14169	22	-0.5646	0.5780606	
Plot5:Sample3	0.000	0.00000	22			
Plot6:Sample1	0.065	0.12271	22	0.5297	0.6016249	
Plot6:Sample2	-0.150	0.14169	22	-1.0586	0.3012597	
Plot6:Sample3	0.000	0.00000	22			
Plot7:Sample1	0.115	0.12271	22	0.9372	0.3588500	
Plot7:Sample2	0.060	0.14169	22	0.4234	0.6760804	
Plot7:Sample3	0.000	0.00000	22			
Plot8:Sample1	0.305	0.12271	22	2.4855	0.0210209	*
Plot8:Sample2	0.180	0.14169	22	1.2703	0.2172344	
Plot8:Sample3	0.000	0.00000	22			
Plot9:Sample1	-0.355	0.12271	22	-2.8930	0.0084403	**
Plot9:Sample2	-0.210	0.14169	22	-1.4821	0.1525064	
Plot9:Sample3	0.000	0.00000	22			
Plot10:Sample1	-0.020	0.12271	22	-0.1630	0.8720183	
Plot10:Sample2	0.000	0.14169	22	0.0000	1.0000000	
Plot10:Sample3	0.000	0.00000	22			
Plot11:Sample1	0.000	0.12271	22	0.0000	1.0000000	
Plot11:Sample2	0.110	0.14169	22	0.7763	0.4458271	
Plot11:Sample3	0.000	0.00000	22			
Plot1:Sample1:Subsample1	0.015	0.10019	22	0.1497	0.8823566	
Plot1:Sample1:Subsample2	0.000	0.00000	22			
Plot1:Sample2:Subsample1	-0.280	0.14169	22	-1.9761	0.0608176	.
Plot1:Sample2:Subsample2	0.000	0.00000	22			
Plot1:Sample3:Subsample1	0.000	0.00000	22			
Plot1:Sample3:Subsample2						
Plot2:Sample1:Subsample1	0.060	0.10019	22	0.5988	0.5553935	
Plot2:Sample1:Subsample2	0.000	0.00000	22			
Plot2:Sample2:Subsample1	-0.390	0.14169	22	-2.7524	0.0116232	*
Plot2:Sample2:Subsample2	0.000	0.00000	22			
Plot2:Sample3:Subsample1	0.000	0.00000	22			
Plot2:Sample3:Subsample2						
Plot3:Sample1:Subsample1	-0.085	0.10019	22	-0.8484	0.4053723	
Plot3:Sample1:Subsample2	0.000	0.00000	22			
Plot3:Sample2:Subsample1	-0.130	0.14169	22	-0.9175	0.3688465	
Plot3:Sample2:Subsample2	0.000	0.00000	22			
Plot3:Sample3:Subsample1	0.000	0.00000	22			
Plot3:Sample3:Subsample2						
Plot4:Sample1:Subsample1	-0.090	0.10019	22	-0.8983	0.3787697	
Plot4:Sample1:Subsample2	0.000	0.00000	22			
Plot4:Sample2:Subsample1	-0.120	0.14169	22	-0.8469	0.4061732	
Plot4:Sample2:Subsample2	0.000	0.00000	22			
Plot4:Sample3:Subsample1	0.000	0.00000	22			
Plot4:Sample3:Subsample2						
Plot5:Sample1:Subsample1	0.300	0.10019	22	2.9942	0.0066835	**
Plot5:Sample1:Subsample2	0.000	0.00000	22			

Plot5:Sample2:Subsample1	0.110	0.14169	22	0.7763	0.4458271
Plot5:Sample2:Subsample2	0.000	0.00000	22		
Plot5:Sample3:Subsample1	0.000	0.00000	22		
Plot5:Sample3:Subsample2					
Plot6:Sample1:Subsample1	0.115	0.10019	22	1.1478	0.2633860
Plot6:Sample1:Subsample2	0.000	0.00000	22		
Plot6:Sample2:Subsample1	0.070	0.14169	22	0.4940	0.6261876
Plot6:Sample2:Subsample2	0.000	0.00000	22		
Plot6:Sample3:Subsample1	0.000	0.00000	22		
Plot6:Sample3:Subsample2					
Plot7:Sample1:Subsample1	0.110	0.10019	22	1.0979	0.2841276
Plot7:Sample1:Subsample2	0.000	0.00000	22		
Plot7:Sample2:Subsample1	-0.060	0.14169	22	-0.4234	0.6760804
Plot7:Sample2:Subsample2	0.000	0.00000	22		
Plot7:Sample3:Subsample1	0.000	0.00000	22		
Plot7:Sample3:Subsample2					
Plot8:Sample1:Subsample1	0.240	0.10019	22	2.3954	0.0255487 *
Plot8:Sample1:Subsample2	0.000	0.00000	22		
Plot8:Sample2:Subsample1	0.100	0.14169	22	0.7057	0.4877535
Plot8:Sample2:Subsample2	0.000	0.00000	22		
Plot8:Sample3:Subsample1	0.000	0.00000	22		
Plot8:Sample3:Subsample2					
Plot9:Sample1:Subsample1	0.020	0.10019	22	0.1996	0.8436154
Plot9:Sample1:Subsample2	0.000	0.00000	22		
Plot9:Sample2:Subsample1	-0.110	0.14169	22	-0.7763	0.4458271
Plot9:Sample2:Subsample2	0.000	0.00000	22		
Plot9:Sample3:Subsample1	0.000	0.00000	22		
Plot9:Sample3:Subsample2					
Plot10:Sample1:Subsample1	0.050	0.10019	22	0.4990	0.6227069
Plot10:Sample1:Subsample2	0.000	0.00000	22		
Plot10:Sample2:Subsample1	-0.060	0.14169	22	-0.4234	0.6760804
Plot10:Sample2:Subsample2	0.000	0.00000	22		
Plot10:Sample3:Subsample1	0.000	0.00000	22		
Plot10:Sample3:Subsample2					
Plot11:Sample1:Subsample1	-0.090	0.10019	22	-0.8983	0.3787697
Plot11:Sample1:Subsample2	0.000	0.00000	22		
Plot11:Sample2:Subsample1	0.030	0.14169	22	0.2117	0.8342720
Plot11:Sample2:Subsample2	0.000	0.00000	22		
Plot11:Sample3:Subsample1	0.000	0.00000	22		
Plot11:Sample3:Subsample2					

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

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

Note: model has aliased coefficients

sums of squares computed by model comparison

Anova Table (Type III tests)

Response: Residue

	Sum Sq	Df	F values	Pr(>F)
Plot	0.00000	0		
Plot:Sample	0.36613	11	3.3156	0.00805 **
Plot:Sample:Subsample	0.35758	22	1.6191	0.13306
Residuals	0.22085	22		

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

NOT OK

7 Federer - Variations

Reference

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

7.1 Example 1.1

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

A3:B2	-2.800	4.1112	36	-0.6811	0.500190
A3:B3	1.900	4.1112	36	0.4621	0.646755
A3:B4	0.000	0.0000	36		
A4:B1	0.000	0.0000	36		
A4:B2	0.000	0.0000	36		
A4:B3	0.000	0.0000	36		
A4:B4	0.000	0.0000	36		

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

7.2 Example 1.2

(68) MODEL

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

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	47	35573	756.88	31.243	< 2.2e-16 ***
RESIDUALS	48	1163	24.23		
CORRECTED TOTAL	95	36736			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	38.6	19.3	0.7963	0.4568480
A	7	763.2	109.0	4.5003	0.0006418 ***
R:A	14	1377.2	98.4	4.0608	0.0001343 ***
B	3	30774.3	10258.1	423.4386	< 2.2e-16 ***
A:B	21	2620.1	124.8	5.1502	1.327e-06 ***

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	38.6	19.3	0.7963	0.4568480
A	7	763.2	109.0	4.5003	0.0006418 ***
R:A	14	1377.2	98.4	4.0608	0.0001343 ***
B	3	30774.3	10258.1	423.4386	< 2.2e-16 ***
A:B	21	2620.1	124.8	5.1502	1.327e-06 ***

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	38.6	19.3	0.7963	0.4568480
A	7	763.2	109.0	4.5003	0.0006418 ***
R:A	14	1377.2	98.4	4.0608	0.0001343 ***
B	3	30774.3	10258.1	423.4386	< 2.2e-16 ***
A:B	21	2620.1	124.8	5.1502	1.327e-06 ***

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	16.000	3.4804	48	4.5972	3.130e-05 ***
R1	-6.250	3.4804	48	-1.7958	0.0788230 .
R2	-5.750	3.4804	48	-1.6521	0.1050354
R3	0.000	0.0000	48		
A0	-7.083	4.9220	48	-1.4391	0.1566037
A1	-4.000	4.9220	48	-0.8127	0.4204117
A2	-4.500	4.9220	48	-0.9143	0.3651450
A3	-6.333	4.9220	48	-1.2868	0.2043526
A4	-3.500	4.9220	48	-0.7111	0.4804644
A5	-1.667	4.9220	48	-0.3386	0.7363740
A6	-6.250	4.9220	48	-1.2698	0.2102707
A7	0.000	0.0000	48		
R1:A0	5.250	4.9220	48	1.0666	0.2914665
R1:A1	15.000	4.9220	48	3.0476	0.0037444 **
R1:A2	-0.500	4.9220	48	-0.1016	0.9195088
R1:A3	7.250	4.9220	48	1.4730	0.1472813
R1:A4	5.000	4.9220	48	1.0159	0.3147916
R1:A5	8.000	4.9220	48	1.6254	0.1106329
R1:A6	10.500	4.9220	48	2.1333	0.0380399 *
R1:A7	0.000	0.0000	48		
R2:A0	5.000	4.9220	48	1.0159	0.3147916
R2:A1	-5.000	4.9220	48	-1.0159	0.3147916
R2:A2	12.000	4.9220	48	2.4381	0.0185190 *
R2:A3	4.750	4.9220	48	0.9651	0.3393506
R2:A4	4.500	4.9220	48	0.9143	0.3651450
R2:A5	12.000	4.9220	48	2.4381	0.0185190 *
R2:A6	2.250	4.9220	48	0.4571	0.6496363
R2:A7	0.000	0.0000	48		
R3:A0	0.000	0.0000	48		
R3:A1	0.000	0.0000	48		
R3:A2	0.000	0.0000	48		
R3:A3	0.000	0.0000	48		
R3:A4	0.000	0.0000	48		
R3:A5	0.000	0.0000	48		
R3:A6	0.000	0.0000	48		

R3:A7	0.000	0.0000	48			
B0	36.000	4.0188	48	8.9580	8.177e-12	***
B1	7.667	4.0188	48	1.9077	0.0624200	.
B2	19.333	4.0188	48	4.8108	1.531e-05	***
B3	0.000	0.0000	48			
A0:B0	22.000	5.6834	48	3.8709	0.0003271	***
A0:B1	-4.333	5.6834	48	-0.7625	0.4495188	
A0:B2	-15.333	5.6834	48	-2.6979	0.0096001	**
A0:B3	0.000	0.0000	48			
A1:B0	16.000	5.6834	48	2.8152	0.0070497	**
A1:B1	-0.667	5.6834	48	-0.1173	0.9071111	
A1:B2	-16.333	5.6834	48	-2.8739	0.0060246	**
A1:B3	0.000	0.0000	48			
A2:B0	17.667	5.6834	48	3.1085	0.0031582	**
A2:B1	-6.333	5.6834	48	-1.1144	0.2706743	
A2:B2	-4.333	5.6834	48	-0.7625	0.4495188	
A2:B3	0.000	0.0000	48			
A3:B0	4.667	5.6834	48	0.8211	0.4156454	
A3:B1	-7.333	5.6834	48	-1.2903	0.2031245	
A3:B2	-15.000	5.6834	48	-2.6393	0.0111717	*
A3:B3	0.000	0.0000	48			
A4:B0	1.667	5.6834	48	0.2933	0.7705935	
A4:B1	-3.000	5.6834	48	-0.5279	0.6000325	
A4:B2	-20.667	5.6834	48	-3.6363	0.0006736	***
A4:B3	0.000	0.0000	48			
A5:B0	5.000	5.6834	48	0.8798	0.3833746	
A5:B1	-16.667	5.6834	48	-2.9325	0.0051395	**
A5:B2	-6.667	5.6834	48	-1.1730	0.2465806	
A5:B3	0.000	0.0000	48			
A6:B0	0.333	5.6834	48	0.0587	0.9534740	
A6:B1	-3.000	5.6834	48	-0.5279	0.6000325	
A6:B2	-7.333	5.6834	48	-1.2903	0.2031245	
A6:B3	0.000	0.0000	48			
A7:B0	0.000	0.0000	48			
A7:B1	0.000	0.0000	48			
A7:B2	0.000	0.0000	48			
A7:B3	0.000	0.0000	48			

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

7.3 Example 2.1

(69) MODEL

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

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

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	41	274.750	6.7012	5.1475	0.0002305 ***
RESIDUALS	18	23.433	1.3019		
CORRECTED TOTAL	59	298.183			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	1	2.817	2.8167	2.1636	0.1585807
A	9	77.683	8.6315	6.6302	0.0003456 ***
R:A	9	81.017	9.0019	6.9147	0.0002658 ***
B	2	35.433	17.7167	13.6088	0.0002510 ***
R:B	2	16.233	8.1167	6.2347	0.0087635 **
A:B	18	61.567	3.4204	2.6273	0.0236253 *

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	1	2.817	2.8167	2.1636	0.1585807
A	9	77.683	8.6315	6.6302	0.0003456 ***
R:A	9	81.017	9.0019	6.9147	0.0002658 ***
B	2	35.433	17.7167	13.6088	0.0002510 ***
R:B	2	16.233	8.1167	6.2347	0.0087635 **
A:B	18	61.567	3.4204	2.6273	0.0236253 *

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	1	2.817	2.8167	2.1636	0.1585807
A	9	77.683	8.6315	6.6302	0.0003456 ***
R:A	9	81.017	9.0019	6.9147	0.0002658 ***
B	2	35.433	17.7167	13.6088	0.0002510 ***
R:B	2	16.233	8.1167	6.2347	0.0087635 **
A:B	18	61.567	3.4204	2.6273	0.0236253 *

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
--	----------	------------	----	---------	----------

(Intercept)	46.583	0.95462	18	48.7979	< 2.2e-16	***
R1	0.833	1.02053	18	0.8166	0.424850	
R2	0.000	0.00000	18			
A0	-3.833	1.31750	18	-2.9096	0.009350	**
A1	2.667	1.31750	18	2.0240	0.058068	.
A2	1.000	1.31750	18	0.7590	0.457669	
A3	-2.167	1.31750	18	-1.6445	0.117418	
A4	1.000	1.31750	18	0.7590	0.457669	
A5	-1.333	1.31750	18	-1.0120	0.324940	
A6	1.500	1.31750	18	1.1385	0.269830	
A7	4.500	1.31750	18	3.4156	0.003083	**
A8	-0.167	1.31750	18	-0.1265	0.900737	
A9	0.000	0.00000	18			
R1:A0	1.667	1.31750	18	1.2650	0.221996	
R1:A1	-3.333	1.31750	18	-2.5300	0.020955	*
R1:A2	-4.000	1.31750	18	-3.0361	0.007105	**
R1:A3	0.333	1.31750	18	0.2530	0.803131	
R1:A4	0.000	1.31750	18	0.0000	1.000000	
R1:A5	2.667	1.31750	18	2.0240	0.058068	.
R1:A6	-4.000	1.31750	18	-3.0361	0.007105	**
R1:A7	-3.000	1.31750	18	-2.2770	0.035225	*
R1:A8	-2.667	1.31750	18	-2.0240	0.058068	.
R1:A9	0.000	0.00000	18			
R2:A0	0.000	0.00000	18			
R2:A1	0.000	0.00000	18			
R2:A2	0.000	0.00000	18			
R2:A3	0.000	0.00000	18			
R2:A4	0.000	0.00000	18			
R2:A5	0.000	0.00000	18			
R2:A6	0.000	0.00000	18			
R2:A7	0.000	0.00000	18			
R2:A8	0.000	0.00000	18			
R2:A9	0.000	0.00000	18			
B1	-3.150	1.19668	18	-2.6323	0.016910	*
B2	-0.600	1.19668	18	-0.5014	0.622175	
B3	0.000	0.00000	18			
R1:B1	2.300	0.72162	18	3.1873	0.005103	**
R1:B2	0.200	0.72162	18	0.2772	0.784821	
R1:B3	0.000	0.00000	18			
R2:B1	0.000	0.00000	18			
R2:B2	0.000	0.00000	18			
R2:B3	0.000	0.00000	18			
A0:B1	3.000	1.61360	18	1.8592	0.079426	.
A0:B2	0.500	1.61360	18	0.3099	0.760221	
A0:B3	0.000	0.00000	18			
A1:B1	-3.000	1.61360	18	-1.8592	0.079426	.
A1:B2	-4.000	1.61360	18	-2.4789	0.023305	*
A1:B3	0.000	0.00000	18			

A2:B1	2.500	1.61360	18	1.5493	0.138705
A2:B2	-2.500	1.61360	18	-1.5493	0.138705
A2:B3	0.000	0.00000	18		
A3:B1	2.000	1.61360	18	1.2395	0.231091
A3:B2	-0.500	1.61360	18	-0.3099	0.760221
A3:B3	0.000	0.00000	18		
A4:B1	-2.000	1.61360	18	-1.2395	0.231091
A4:B2	-1.000	1.61360	18	-0.6197	0.543200
A4:B3	0.000	0.00000	18		
A5:B1	1.000	1.61360	18	0.6197	0.543200
A5:B2	0.000	1.61360	18	0.0000	1.000000
A5:B3	0.000	0.00000	18		
A6:B1	-1.000	1.61360	18	-0.6197	0.543200
A6:B2	-0.500	1.61360	18	-0.3099	0.760221
A6:B3	0.000	0.00000	18		
A7:B1	-0.500	1.61360	18	-0.3099	0.760221
A7:B2	-2.000	1.61360	18	-1.2395	0.231091
A7:B3	0.000	0.00000	18		
A8:B1	2.500	1.61360	18	1.5493	0.138705
A8:B2	-2.000	1.61360	18	-1.2395	0.231091
A8:B3	0.000	0.00000	18		
A9:B1	0.000	0.00000	18		
A9:B2	0.000	0.00000	18		
A9:B3	0.000	0.00000	18		

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

7.4 Example 2.2

(70) MODEL

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

\$ANOVA

Response : Y

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

\$`Type I`

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

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

\$`Type II`

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

\$`Type III`

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	1000.52	11.393	48	87.8167	< 2e-16 ***
Column1	12.04	14.132	48	0.8522	0.39836
Column2	10.64	14.132	48	0.7529	0.45520
Column3	0.98	14.132	48	0.0696	0.94478
Column4	-12.93	14.132	48	-0.9149	0.36480
Column5	0.00	0.000	48		
R1	-13.81	14.132	48	-0.9774	0.33325
R2	-10.85	14.132	48	-0.7678	0.44636
R3	-2.17	14.132	48	-0.1533	0.87880
R4	-3.63	14.132	48	-0.2571	0.79819
R5	0.00	0.000	48		
Column1:R1	16.78	15.800	48	1.0619	0.29360
Column1:R2	5.34	15.800	48	0.3383	0.73661
Column1:R3	-9.13	15.800	48	-0.5775	0.56627
Column1:R4	-6.31	15.800	48	-0.3994	0.69139
Column1:R5	0.00	0.000	48		
Column2:R1	16.71	15.800	48	1.0578	0.29545
Column2:R2	-1.64	15.800	48	-0.1036	0.91789
Column2:R3	7.40	15.800	48	0.4687	0.64142
Column2:R4	11.71	15.800	48	0.7413	0.46212
Column2:R5	0.00	0.000	48		
Column3:R1	12.12	15.800	48	0.7671	0.44678
Column3:R2	0.27	15.800	48	0.0169	0.98656

Column3:R3	-14.04	15.800	48	-0.8885	0.37872
Column3:R4	9.01	15.800	48	0.5703	0.57116
Column3:R5	0.00	0.000	48		
Column4:R1	1.31	15.800	48	0.0832	0.93402
Column4:R2	-3.85	15.800	48	-0.2438	0.80840
Column4:R3	0.84	15.800	48	0.0532	0.95782
Column4:R4	9.65	15.800	48	0.6111	0.54402
Column4:R5	0.00	0.000	48		
Column5:R1	0.00	0.000	48		
Column5:R2	0.00	0.000	48		
Column5:R3	0.00	0.000	48		
Column5:R4	0.00	0.000	48		
Column5:R5	0.00	0.000	48		
S1	3.74	13.406	48	0.2789	0.78154
S2	12.15	13.406	48	0.9066	0.36916
S3	2.83	13.406	48	0.2110	0.83380
S4	0.00	0.000	48		
Column1:S1	-15.16	14.132	48	-1.0730	0.28861
Column1:S2	-31.48	14.132	48	-2.2278	0.03062 *
Column1:S3	1.26	14.132	48	0.0889	0.92955
Column1:S4	0.00	0.000	48		
Column2:S1	-22.54	14.132	48	-1.5947	0.11734
Column2:S2	-31.01	14.132	48	-2.1946	0.03306 *
Column2:S3	-3.56	14.132	48	-0.2518	0.80229
Column2:S4	0.00	0.000	48		
Column3:S1	-1.71	14.132	48	-0.1207	0.90442
Column3:S2	-14.46	14.132	48	-1.0229	0.31146
Column3:S3	19.65	14.132	48	1.3902	0.17088
Column3:S4	0.00	0.000	48		
Column4:S1	5.39	14.132	48	0.3816	0.70448
Column4:S2	-3.36	14.132	48	-0.2376	0.81319
Column4:S3	17.58	14.132	48	1.2443	0.21943
Column4:S4	0.00	0.000	48		
Column5:S1	0.00	0.000	48		
Column5:S2	0.00	0.000	48		
Column5:S3	0.00	0.000	48		
Column5:S4	0.00	0.000	48		
R1:S1	3.84	14.132	48	0.2714	0.78721
R1:S2	-1.62	14.132	48	-0.1148	0.90910
R1:S3	-11.37	14.132	48	-0.8047	0.42495
R1:S4	0.00	0.000	48		
R2:S1	12.02	14.132	48	0.8507	0.39915
R2:S2	10.32	14.132	48	0.7300	0.46894
R2:S3	-6.46	14.132	48	-0.4568	0.64984
R2:S4	0.00	0.000	48		
R3:S1	9.62	14.132	48	0.6810	0.49913
R3:S2	2.19	14.132	48	0.1551	0.87738
R3:S3	-8.14	14.132	48	-0.5760	0.56730

R3:S4	0.00	0.000	48		
R4:S1	4.15	14.132	48	0.2939	0.77006
R4:S2	3.09	14.132	48	0.2189	0.82762
R4:S3	-6.44	14.132	48	-0.4560	0.65045
R4:S4	0.00	0.000	48		
R5:S1	0.00	0.000	48		
R5:S2	0.00	0.000	48		
R5:S3	0.00	0.000	48		
R5:S4	0.00	0.000	48		

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

(71) MODEL

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

\$ANOVA

Response : Y

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

\$`Type I`

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

\$`Type II`

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

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Row	0				

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	1001.61		0		
Row1	-5.98		0		
Row2	16.88		0		
Row3	19.34		0		
Row4	-24.93		0		
Row5	0.00		0		
R1	9.12		0		
R2	-18.93		0		
R3	-2.75		0		
R4	3.02		0		
R5	0.00		0		
Row1:R1	3.72		0		
Row1:R2	14.16		0		
Row1:R3	-24.63		0		
Row1:R4	3.52		0		
Row1:R5	0.00		0		
Row2:R1	-61.81		0		
Row2:R2	12.43		0		
Row2:R3	-0.94		0		
Row2:R4	-20.79		0		
Row2:R5	0.00		0		
Row3:R1	-56.60		0		
Row3:R2	-12.11		0		
Row3:R3	-30.06		0		
Row3:R4	-4.44		0		
Row3:R5	0.00		0		
Row4:R1	46.95		0		
Row4:R2	26.04		0		
Row4:R3	43.63		0		
Row4:R4	12.51		0		
Row4:R5	0.00		0		
Row5:R1	0.00		0		
Row5:R2	0.00		0		
Row5:R3	0.00		0		
Row5:R4	0.00		0		
Row5:R5	0.00		0		
S1	24.26		0		
S2	21.85		0		
S3	-7.81		0		

S4	0.00	0
S1:Column1	-47.84	0
S1:Column2	-58.48	0
S1:Column3	-40.38	0
S1:Column4	10.08	0
S1:Column5	0.00	0
S2:Column1	-40.43	0
S2:Column2	-13.68	0
S2:Column3	-58.94	0
S2:Column4	-15.74	0
S2:Column5	0.00	0
S3:Column1	-0.39	0
S3:Column2	33.69	0
S3:Column3	5.46	0
S3:Column4	49.36	0
S3:Column5	0.00	0
S4:Column1	0.00	0
S4:Column2	0.00	0
S4:Column3	0.00	0
S4:Column4	0.00	0
S4:Column5	0.00	0
R1:S1	-12.01	0
R1:S2	17.28	0
R1:S3	18.96	0
R1:S4	0.00	0
R2:S1	-39.64	0
R2:S2	-21.90	0
R2:S3	-31.42	0
R2:S4	0.00	0
R3:S1	-10.98	0
R3:S2	-21.39	0
R3:S3	14.46	0
R3:S4	0.00	0
R4:S1	-10.34	0
R4:S2	-8.49	0
R4:S3	18.78	0
R4:S4	0.00	0
R5:S1	0.00	0
R5:S2	0.00	0
R5:S3	0.00	0
R5:S4	0.00	0
R1:S1:Column1	54.97	0
R1:S1:Column2	5.27	0
R1:S1:Column3	10.94	0
R1:S1:Column4	8.05	0
R1:S1:Column5	0.00	0
R1:S2:Column1	-24.43	0
R1:S2:Column2	-78.73	0

R1:S2:Column3	15.88	0
R1:S2:Column4	-7.23	0
R1:S2:Column5	0.00	0
R1:S3:Column1	-11.99	0
R1:S3:Column2	-72.89	0
R1:S3:Column3	-26.10	0
R1:S3:Column4	-40.68	0
R1:S3:Column5	0.00	0
R1:S4:Column1	0.00	0
R1:S4:Column2	0.00	0
R1:S4:Column3	0.00	0
R1:S4:Column4	0.00	0
R1:S4:Column5	0.00	0
R2:S1:Column1	86.83	0
R2:S1:Column2	87.33	0
R2:S1:Column3	76.49	0
R2:S1:Column4	7.66	0
R2:S1:Column5	0.00	0
R2:S2:Column1	67.97	0
R2:S2:Column2	0.73	0
R2:S2:Column3	71.73	0
R2:S2:Column4	20.65	0
R2:S2:Column5	0.00	0
R2:S3:Column1	46.34	0
R2:S3:Column2	13.83	0
R2:S3:Column3	66.93	0
R2:S3:Column4	-2.28	0
R2:S3:Column5	0.00	0
R2:S4:Column1	0.00	0
R2:S4:Column2	0.00	0
R2:S4:Column3	0.00	0
R2:S4:Column4	0.00	0
R2:S4:Column5	0.00	0
R3:S1:Column1	7.17	0
R3:S1:Column2	52.01	0
R3:S1:Column3	51.42	0
R3:S1:Column4	-7.58	0
R3:S1:Column5	0.00	0
R3:S2:Column1	-5.38	0
R3:S2:Column2	12.88	0
R3:S2:Column3	83.94	0
R3:S2:Column4	26.47	0
R3:S2:Column5	0.00	0
R3:S3:Column1	-21.65	0
R3:S3:Column2	-75.11	0
R3:S3:Column3	32.21	0
R3:S3:Column4	-48.45	0
R3:S3:Column5	0.00	0

R3:S4:Column1	0.00	0
R3:S4:Column2	0.00	0
R3:S4:Column3	0.00	0
R3:S4:Column4	0.00	0
R3:S4:Column5	0.00	0
R4:S1:Column1	14.41	0
R4:S1:Column2	35.11	0
R4:S1:Column3	54.52	0
R4:S1:Column4	-31.57	0
R4:S1:Column5	0.00	0
R4:S2:Column1	6.58	0
R4:S2:Column2	-21.55	0
R4:S2:Column3	50.87	0
R4:S2:Column4	22.02	0
R4:S2:Column5	0.00	0
R4:S3:Column1	-4.47	0
R4:S3:Column2	-52.07	0
R4:S3:Column3	-2.11	0
R4:S3:Column4	-67.47	0
R4:S3:Column5	0.00	0
R4:S4:Column1	0.00	0
R4:S4:Column2	0.00	0
R4:S4:Column3	0.00	0
R4:S4:Column4	0.00	0
R4:S4:Column5	0.00	0
R5:S1:Column1	0.00	0
R5:S1:Column2	0.00	0
R5:S1:Column3	0.00	0
R5:S1:Column4	0.00	0
R5:S1:Column5	0.00	0
R5:S2:Column1	0.00	0
R5:S2:Column2	0.00	0
R5:S2:Column3	0.00	0
R5:S2:Column4	0.00	0
R5:S2:Column5	0.00	0
R5:S3:Column1	0.00	0
R5:S3:Column2	0.00	0
R5:S3:Column3	0.00	0
R5:S3:Column4	0.00	0
R5:S3:Column5	0.00	0
R5:S4:Column1	0.00	0
R5:S4:Column2	0.00	0
R5:S4:Column3	0.00	0
R5:S4:Column4	0.00	0
R5:S4:Column5	0.00	0

(72) MODEL

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

```
$ANOVA
```

```
Response : Y
```

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

```
$`Type I`
```

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

```
$`Type II`
```

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

```
$`Type III`
```

```
CAUTION: Singularity Exists !
```

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

```
$Parameter
```

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

Row5	0.00	0
R1	9.12	0
R2	-18.93	0
R3	-2.75	0
R4	3.02	0
R5	0.00	0
S1	24.26	0
S2	21.85	0
S3	-7.81	0
S4	0.00	0
R1:S1	-12.01	0
R1:S2	17.28	0
R1:S3	18.96	0
R1:S4	0.00	0
R2:S1	-39.64	0
R2:S2	-21.90	0
R2:S3	-31.42	0
R2:S4	0.00	0
R3:S1	-10.98	0
R3:S2	-21.39	0
R3:S3	14.46	0
R3:S4	0.00	0
R4:S1	-10.34	0
R4:S2	-8.49	0
R4:S3	18.78	0
R4:S4	0.00	0
R5:S1	0.00	0
R5:S2	0.00	0
R5:S3	0.00	0
R5:S4	0.00	0
Row1:R1	3.72	0
Row1:R2	14.16	0
Row1:R3	-24.63	0
Row1:R4	3.52	0
Row1:R5	0.00	0
Row2:R1	-61.81	0
Row2:R2	12.43	0
Row2:R3	-0.94	0
Row2:R4	-20.79	0
Row2:R5	0.00	0
Row3:R1	-56.60	0
Row3:R2	-12.11	0
Row3:R3	-30.06	0
Row3:R4	-4.44	0
Row3:R5	0.00	0
Row4:R1	46.95	0
Row4:R2	26.04	0
Row4:R3	43.63	0

Row4:R4	12.51	0
Row4:R5	0.00	0
Row5:R1	0.00	0
Row5:R2	0.00	0
Row5:R3	0.00	0
Row5:R4	0.00	0
Row5:R5	0.00	0
S1:Column1	-47.84	0
S1:Column2	-58.48	0
S1:Column3	-40.38	0
S1:Column4	10.08	0
S1:Column5	0.00	0
S2:Column1	-40.43	0
S2:Column2	-13.68	0
S2:Column3	-58.94	0
S2:Column4	-15.74	0
S2:Column5	0.00	0
S3:Column1	-0.39	0
S3:Column2	33.69	0
S3:Column3	5.46	0
S3:Column4	49.36	0
S3:Column5	0.00	0
S4:Column1	0.00	0
S4:Column2	0.00	0
S4:Column3	0.00	0
S4:Column4	0.00	0
S4:Column5	0.00	0
R1:S1:Column1	54.97	0
R1:S1:Column2	5.27	0
R1:S1:Column3	10.94	0
R1:S1:Column4	8.05	0
R1:S1:Column5	0.00	0
R1:S2:Column1	-24.43	0
R1:S2:Column2	-78.73	0
R1:S2:Column3	15.88	0
R1:S2:Column4	-7.23	0
R1:S2:Column5	0.00	0
R1:S3:Column1	-11.99	0
R1:S3:Column2	-72.89	0
R1:S3:Column3	-26.10	0
R1:S3:Column4	-40.68	0
R1:S3:Column5	0.00	0
R1:S4:Column1	0.00	0
R1:S4:Column2	0.00	0
R1:S4:Column3	0.00	0
R1:S4:Column4	0.00	0
R1:S4:Column5	0.00	0
R2:S1:Column1	86.83	0

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

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

```
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

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

\$ANOVA

Response : Yield

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	239	2724374186	11399055	23.682	< 2.2e-16 ***
RESIDUALS	240	115521933	481341		
CORRECTED TOTAL	479	2839896119			

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

\$`Type I`

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

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

\$`Type II`

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

Site:B:C	36	88610	2461	0.0051	1.00000
Site:A:B:C	36	98025	2723	0.0057	1.00000

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

\$`Type III`

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

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	6915.2	490.58	240	14.0958	< 2.2e-16 ***
Site1	-54.7	693.79	240	-0.0788	0.9372617
Site2	2003.4	693.79	240	2.8877	0.0042356 **
Site3	2418.5	693.79	240	3.4859	0.0005830 ***
Site4	0.0	0.00	240		
Site1:BlockR1	4457.0	490.58	240	9.0851	< 2.2e-16 ***
Site1:BlockR2	2855.5	490.58	240	5.8206	1.868e-08 ***
Site1:BlockR3	0.0	0.00	240		
Site2:BlockR1	4495.5	490.58	240	9.1636	< 2.2e-16 ***
Site2:BlockR2	2894.7	490.58	240	5.9006	1.226e-08 ***
Site2:BlockR3	0.0	0.00	240		
Site3:BlockR1	4527.2	490.58	240	9.2283	< 2.2e-16 ***
Site3:BlockR2	2863.7	490.58	240	5.8375	1.710e-08 ***
Site3:BlockR3	0.0	0.00	240		
Site4:BlockR1	4467.3	490.58	240	9.1060	< 2.2e-16 ***
Site4:BlockR2	2810.3	490.58	240	5.7284	3.022e-08 ***
Site4:BlockR3	0.0	0.00	240		
AA1	-91.2	693.79	240	-0.1315	0.8954707
AA2	0.0	0.00	240		

BB1	-442.7	693.79	240	-0.6380	0.5240537
BB2	-366.4	693.79	240	-0.5281	0.5978905
BB3	-224.9	693.79	240	-0.3242	0.7460791
BB4	-200.5	693.79	240	-0.2890	0.7728360
BB5	0.0	0.00	240		
AA1:BB1	56.4	981.16	240	0.0575	0.9541950
AA1:BB2	76.1	981.16	240	0.0775	0.9382554
AA1:BB3	-3.7	981.16	240	-0.0037	0.9970214
AA1:BB4	141.0	981.16	240	0.1437	0.8858525
AA1:BB5	0.0	0.00	240		
AA2:BB1	0.0	0.00	240		
AA2:BB2	0.0	0.00	240		
AA2:BB3	0.0	0.00	240		
AA2:BB4	0.0	0.00	240		
AA2:BB5	0.0	0.00	240		
Site1:AA1	70.5	981.16	240	0.0719	0.9427784
Site1:AA2	0.0	0.00	240		
Site2:AA1	-7.3	981.16	240	-0.0074	0.9941105
Site2:AA2	0.0	0.00	240		
Site3:AA1	64.6	981.16	240	0.0658	0.9475734
Site3:AA2	0.0	0.00	240		
Site4:AA1	0.0	0.00	240		
Site4:AA2	0.0	0.00	240		
Site1:BB1	99.7	981.16	240	0.1016	0.9191748
Site1:BB2	69.5	981.16	240	0.0708	0.9435887
Site1:BB3	127.2	981.16	240	0.1297	0.8969180
Site1:BB4	155.4	981.16	240	0.1584	0.8742746
Site1:BB5	0.0	0.00	240		
Site2:BB1	21.7	981.16	240	0.0222	0.9823327
Site2:BB2	4.6	981.16	240	0.0047	0.9962767
Site2:BB3	-3.7	981.16	240	-0.0037	0.9970214
Site2:BB4	66.5	981.16	240	0.0678	0.9460199
Site2:BB5	0.0	0.00	240		
Site3:BB1	55.6	981.16	240	0.0567	0.9548708
Site3:BB2	74.7	981.16	240	0.0762	0.9393354
Site3:BB3	53.5	981.16	240	0.0545	0.9565606
Site3:BB4	160.8	981.16	240	0.1639	0.8699313
Site3:BB5	0.0	0.00	240		
Site4:BB1	0.0	0.00	240		
Site4:BB2	0.0	0.00	240		
Site4:BB3	0.0	0.00	240		
Site4:BB4	0.0	0.00	240		
Site4:BB5	0.0	0.00	240		
Site1:AA1:BB1	-38.2	1387.58	240	-0.0276	0.9780312
Site1:AA1:BB2	-103.7	1387.58	240	-0.0747	0.9405072
Site1:AA1:BB3	-46.3	1387.58	240	-0.0334	0.9733901
Site1:AA1:BB4	-172.2	1387.58	240	-0.1241	0.9013579
Site1:AA1:BB5	0.0	0.00	240		

Site1:AA2:BB1	0.0	0.00	240		
Site1:AA2:BB2	0.0	0.00	240		
Site1:AA2:BB3	0.0	0.00	240		
Site1:AA2:BB4	0.0	0.00	240		
Site1:AA2:BB5	0.0	0.00	240		
Site2:AA1:BB1	-47.2	1387.58	240	-0.0340	0.9729117
Site2:AA1:BB2	-26.1	1387.58	240	-0.0188	0.9850180
Site2:AA1:BB3	25.0	1387.58	240	0.0180	0.9856402
Site2:AA1:BB4	-109.2	1387.58	240	-0.0787	0.9373572
Site2:AA1:BB5	0.0	0.00	240		
Site2:AA2:BB1	0.0	0.00	240		
Site2:AA2:BB2	0.0	0.00	240		
Site2:AA2:BB3	0.0	0.00	240		
Site2:AA2:BB4	0.0	0.00	240		
Site2:AA2:BB5	0.0	0.00	240		
Site3:AA1:BB1	-48.0	1387.58	240	-0.0346	0.9724333
Site3:AA1:BB2	-87.7	1387.58	240	-0.0632	0.9496282
Site3:AA1:BB3	1.3	1387.58	240	0.0010	0.9992341
Site3:AA1:BB4	-86.4	1387.58	240	-0.0623	0.9503926
Site3:AA1:BB5	0.0	0.00	240		
Site3:AA2:BB1	0.0	0.00	240		
Site3:AA2:BB2	0.0	0.00	240		
Site3:AA2:BB3	0.0	0.00	240		
Site3:AA2:BB4	0.0	0.00	240		
Site3:AA2:BB5	0.0	0.00	240		
Site4:AA1:BB1	0.0	0.00	240		
Site4:AA1:BB2	0.0	0.00	240		
Site4:AA1:BB3	0.0	0.00	240		
Site4:AA1:BB4	0.0	0.00	240		
Site4:AA1:BB5	0.0	0.00	240		
Site4:AA2:BB1	0.0	0.00	240		
Site4:AA2:BB2	0.0	0.00	240		
Site4:AA2:BB3	0.0	0.00	240		
Site4:AA2:BB4	0.0	0.00	240		
Site4:AA2:BB5	0.0	0.00	240		
Site1:BlockR1:AA1:BB1	-928.2	693.79	240	-1.3379	0.1821806
Site1:BlockR1:AA1:BB2	-733.2	693.79	240	-1.0569	0.2916292
Site1:BlockR1:AA1:BB3	-514.0	693.79	240	-0.7409	0.4595022
Site1:BlockR1:AA1:BB4	-350.2	693.79	240	-0.5048	0.6141363
Site1:BlockR1:AA1:BB5	-106.7	693.79	240	-0.1539	0.8778451
Site1:BlockR1:AA2:BB1	-900.7	693.79	240	-1.2983	0.1954278
Site1:BlockR1:AA2:BB2	-683.7	693.79	240	-0.9855	0.3253553
Site1:BlockR1:AA2:BB3	-415.7	693.79	240	-0.5992	0.5495736
Site1:BlockR1:AA2:BB4	-216.5	693.79	240	-0.3121	0.7552696
Site1:BlockR1:AA2:BB5	0.0	0.00	240		
Site1:BlockR2:AA1:BB1	-744.0	693.79	240	-1.0724	0.2846291
Site1:BlockR2:AA1:BB2	-533.0	693.79	240	-0.7682	0.4430960
Site1:BlockR2:AA1:BB3	-417.7	693.79	240	-0.6021	0.5476564

Site1:BlockR2:AA1:BB4	-277.7	693.79	240	-0.4003	0.6892633
Site1:BlockR2:AA1:BB5	-80.0	693.79	240	-0.1153	0.9082966
Site1:BlockR2:AA2:BB1	-713.2	693.79	240	-1.0281	0.3049602
Site1:BlockR2:AA2:BB2	-488.5	693.79	240	-0.7041	0.4820495
Site1:BlockR2:AA2:BB3	-373.2	693.79	240	-0.5380	0.5910833
Site1:BlockR2:AA2:BB4	-231.2	693.79	240	-0.3333	0.7391874
Site1:BlockR2:AA2:BB5	0.0	0.00	240		
Site1:BlockR3:AA1:BB1	0.0	0.00	240		
Site1:BlockR3:AA1:BB2	0.0	0.00	240		
Site1:BlockR3:AA1:BB3	0.0	0.00	240		
Site1:BlockR3:AA1:BB4	0.0	0.00	240		
Site1:BlockR3:AA1:BB5	0.0	0.00	240		
Site1:BlockR3:AA2:BB1	0.0	0.00	240		
Site1:BlockR3:AA2:BB2	0.0	0.00	240		
Site1:BlockR3:AA2:BB3	0.0	0.00	240		
Site1:BlockR3:AA2:BB4	0.0	0.00	240		
Site1:BlockR3:AA2:BB5	0.0	0.00	240		
Site2:BlockR1:AA1:BB1	-974.5	693.79	240	-1.4046	0.1614307
Site2:BlockR1:AA1:BB2	-779.5	693.79	240	-1.1235	0.2623297
Site2:BlockR1:AA1:BB3	-559.5	693.79	240	-0.8064	0.4207860
Site2:BlockR1:AA1:BB4	-301.0	693.79	240	-0.4339	0.6647869
Site2:BlockR1:AA1:BB5	-172.0	693.79	240	-0.2479	0.8044126
Site2:BlockR1:AA2:BB1	-878.8	693.79	240	-1.2666	0.2065270
Site2:BlockR1:AA2:BB2	-603.5	693.79	240	-0.8699	0.3852446
Site2:BlockR1:AA2:BB3	-392.3	693.79	240	-0.5654	0.5723471
Site2:BlockR1:AA2:BB4	-212.5	693.79	240	-0.3063	0.7596497
Site2:BlockR1:AA2:BB5	0.0	0.00	240		
Site2:BlockR2:AA1:BB1	-725.0	693.79	240	-1.0450	0.2970798
Site2:BlockR2:AA1:BB2	-572.5	693.79	240	-0.8252	0.4100886
Site2:BlockR2:AA1:BB3	-427.2	693.79	240	-0.6158	0.5385953
Site2:BlockR2:AA1:BB4	-278.0	693.79	240	-0.4007	0.6889983
Site2:BlockR2:AA1:BB5	-144.5	693.79	240	-0.2083	0.8351894
Site2:BlockR2:AA2:BB1	-629.5	693.79	240	-0.9073	0.3651382
Site2:BlockR2:AA2:BB2	-530.0	693.79	240	-0.7639	0.4456638
Site2:BlockR2:AA2:BB3	-304.0	693.79	240	-0.4382	0.6616540
Site2:BlockR2:AA2:BB4	-204.5	693.79	240	-0.2948	0.7684330
Site2:BlockR2:AA2:BB5	0.0	0.00	240		
Site2:BlockR3:AA1:BB1	0.0	0.00	240		
Site2:BlockR3:AA1:BB2	0.0	0.00	240		
Site2:BlockR3:AA1:BB3	0.0	0.00	240		
Site2:BlockR3:AA1:BB4	0.0	0.00	240		
Site2:BlockR3:AA1:BB5	0.0	0.00	240		
Site2:BlockR3:AA2:BB1	0.0	0.00	240		
Site2:BlockR3:AA2:BB2	0.0	0.00	240		
Site2:BlockR3:AA2:BB3	0.0	0.00	240		
Site2:BlockR3:AA2:BB4	0.0	0.00	240		
Site2:BlockR3:AA2:BB5	0.0	0.00	240		
Site3:BlockR1:AA1:BB1	-1029.0	693.79	240	-1.4832	0.1393432

Site3:BlockR1:AA1:BB2	-781.0	693.79	240	-1.1257	0.2614150
Site3:BlockR1:AA1:BB3	-555.2	693.79	240	-0.8003	0.4243187
Site3:BlockR1:AA1:BB4	-442.5	693.79	240	-0.6378	0.5242099
Site3:BlockR1:AA1:BB5	-152.7	693.79	240	-0.2202	0.8259273
Site3:BlockR1:AA2:BB1	-858.5	693.79	240	-1.2374	0.2171441
Site3:BlockR1:AA2:BB2	-683.7	693.79	240	-0.9855	0.3253553
Site3:BlockR1:AA2:BB3	-453.7	693.79	240	-0.6540	0.5137261
Site3:BlockR1:AA2:BB4	-213.2	693.79	240	-0.3074	0.7588278
Site3:BlockR1:AA2:BB5	0.0	0.00	240		
Site3:BlockR2:AA1:BB1	-756.0	693.79	240	-1.0897	0.2769512
Site3:BlockR2:AA1:BB2	-566.0	693.79	240	-0.8158	0.4154169
Site3:BlockR2:AA1:BB3	-354.5	693.79	240	-0.5110	0.6098465
Site3:BlockR2:AA1:BB4	-266.2	693.79	240	-0.3838	0.7014939
Site3:BlockR2:AA1:BB5	-87.2	693.79	240	-0.1258	0.9000280
Site3:BlockR2:AA2:BB1	-619.2	693.79	240	-0.8926	0.3729847
Site3:BlockR2:AA2:BB2	-448.2	693.79	240	-0.6461	0.5188377
Site3:BlockR2:AA2:BB3	-261.0	693.79	240	-0.3762	0.7071037
Site3:BlockR2:AA2:BB4	-175.7	693.79	240	-0.2533	0.8002381
Site3:BlockR2:AA2:BB5	0.0	0.00	240		
Site3:BlockR3:AA1:BB1	0.0	0.00	240		
Site3:BlockR3:AA1:BB2	0.0	0.00	240		
Site3:BlockR3:AA1:BB3	0.0	0.00	240		
Site3:BlockR3:AA1:BB4	0.0	0.00	240		
Site3:BlockR3:AA1:BB5	0.0	0.00	240		
Site3:BlockR3:AA2:BB1	0.0	0.00	240		
Site3:BlockR3:AA2:BB2	0.0	0.00	240		
Site3:BlockR3:AA2:BB3	0.0	0.00	240		
Site3:BlockR3:AA2:BB4	0.0	0.00	240		
Site3:BlockR3:AA2:BB5	0.0	0.00	240		
Site4:BlockR1:AA1:BB1	-920.0	693.79	240	-1.3261	0.1860824
Site4:BlockR1:AA1:BB2	-756.0	693.79	240	-1.0897	0.2769512
Site4:BlockR1:AA1:BB3	-550.5	693.79	240	-0.7935	0.4282876
Site4:BlockR1:AA1:BB4	-312.5	693.79	240	-0.4504	0.6528099
Site4:BlockR1:AA1:BB5	-94.0	693.79	240	-0.1355	0.8923395
Site4:BlockR1:AA2:BB1	-825.8	693.79	240	-1.1902	0.2351416
Site4:BlockR1:AA2:BB2	-603.3	693.79	240	-0.8695	0.3854412
Site4:BlockR1:AA2:BB3	-425.0	693.79	240	-0.6126	0.5407345
Site4:BlockR1:AA2:BB4	-154.8	693.79	240	-0.2231	0.8236856
Site4:BlockR1:AA2:BB5	0.0	0.00	240		
Site4:BlockR2:AA1:BB1	-664.5	693.79	240	-0.9578	0.3391346
Site4:BlockR2:AA1:BB2	-552.3	693.79	240	-0.7960	0.4268228
Site4:BlockR2:AA1:BB3	-366.0	693.79	240	-0.5275	0.5983068
Site4:BlockR2:AA1:BB4	-213.3	693.79	240	-0.3074	0.7588278
Site4:BlockR2:AA1:BB5	-1.3	693.79	240	-0.0018	0.9985639
Site4:BlockR2:AA2:BB1	-547.3	693.79	240	-0.7888	0.4310156
Site4:BlockR2:AA2:BB2	-434.5	693.79	240	-0.6263	0.5317316
Site4:BlockR2:AA2:BB3	-320.3	693.79	240	-0.4616	0.6447888
Site4:BlockR2:AA2:BB4	-79.8	693.79	240	-0.1149	0.9085819

Site4:BlockR2:AA2:BB5	0.0	0.00	240			
Site4:BlockR3:AA1:BB1	0.0	0.00	240			
Site4:BlockR3:AA1:BB2	0.0	0.00	240			
Site4:BlockR3:AA1:BB3	0.0	0.00	240			
Site4:BlockR3:AA1:BB4	0.0	0.00	240			
Site4:BlockR3:AA1:BB5	0.0	0.00	240			
Site4:BlockR3:AA2:BB1	0.0	0.00	240			
Site4:BlockR3:AA2:BB2	0.0	0.00	240			
Site4:BlockR3:AA2:BB3	0.0	0.00	240			
Site4:BlockR3:AA2:BB4	0.0	0.00	240			
Site4:BlockR3:AA2:BB5	0.0	0.00	240			
CC1	-3320.7	566.48	240	-5.8620	1.503e-08	***
CC2	-2205.0	566.48	240	-3.8925	0.0001286	***
CC3	-1108.0	566.48	240	-1.9560	0.0516306	.
CC4	0.0	0.00	240			
AA1:CC1	-1.7	801.12	240	-0.0021	0.9983418	
AA1:CC2	-17.0	801.12	240	-0.0212	0.9830875	
AA1:CC3	21.7	801.12	240	0.0270	0.9784459	
AA1:CC4	0.0	0.00	240			
AA2:CC1	0.0	0.00	240			
AA2:CC2	0.0	0.00	240			
AA2:CC3	0.0	0.00	240			
AA2:CC4	0.0	0.00	240			
BB1:CC1	-36.7	801.12	240	-0.0458	0.9635321	
BB1:CC2	-13.0	801.12	240	-0.0162	0.9870665	
BB1:CC3	13.3	801.12	240	0.0166	0.9867349	
BB1:CC4	0.0	0.00	240			
BB2:CC1	-28.0	801.12	240	-0.0350	0.9721477	
BB2:CC2	27.7	801.12	240	0.0345	0.9724791	
BB2:CC3	62.0	801.12	240	0.0774	0.9383762	
BB2:CC4	0.0	0.00	240			
BB3:CC1	-21.0	801.12	240	-0.0262	0.9791089	
BB3:CC2	20.3	801.12	240	0.0254	0.9797720	
BB3:CC3	36.3	801.12	240	0.0454	0.9638634	
BB3:CC4	0.0	0.00	240			
BB4:CC1	18.7	801.12	240	0.0233	0.9814297	
BB4:CC2	28.0	801.12	240	0.0350	0.9721477	
BB4:CC3	84.3	801.12	240	0.1053	0.9162497	
BB4:CC4	0.0	0.00	240			
BB5:CC1	0.0	0.00	240			
BB5:CC2	0.0	0.00	240			
BB5:CC3	0.0	0.00	240			
BB5:CC4	0.0	0.00	240			
AA1:BB1:CC1	51.7	1132.95	240	0.0456	0.9636641	
AA1:BB1:CC2	7.7	1132.95	240	0.0068	0.9946064	
AA1:BB1:CC3	-16.0	1132.95	240	-0.0141	0.9887440	
AA1:BB1:CC4	0.0	0.00	240			
AA1:BB2:CC1	51.3	1132.95	240	0.0453	0.9638984	

AA1:BB2:CC2	-52.3	1132.95	240	-0.0462	0.9631956
AA1:BB2:CC3	-88.3	1132.95	240	-0.0780	0.9379189
AA1:BB2:CC4	0.0	0.00	240		
AA1:BB3:CC1	97.3	1132.95	240	0.0859	0.9316085
AA1:BB3:CC2	74.0	1132.95	240	0.0653	0.9479766
AA1:BB3:CC3	-26.7	1132.95	240	-0.0235	0.9812412
AA1:BB3:CC4	0.0	0.00	240		
AA1:BB4:CC1	-78.0	1132.95	240	-0.0688	0.9451689
AA1:BB4:CC2	-27.7	1132.95	240	-0.0244	0.9805379
AA1:BB4:CC3	-67.3	1132.95	240	-0.0594	0.9526576
AA1:BB4:CC4	0.0	0.00	240		
AA1:BB5:CC1	0.0	0.00	240		
AA1:BB5:CC2	0.0	0.00	240		
AA1:BB5:CC3	0.0	0.00	240		
AA1:BB5:CC4	0.0	0.00	240		
AA2:BB1:CC1	0.0	0.00	240		
AA2:BB1:CC2	0.0	0.00	240		
AA2:BB1:CC3	0.0	0.00	240		
AA2:BB1:CC4	0.0	0.00	240		
AA2:BB2:CC1	0.0	0.00	240		
AA2:BB2:CC2	0.0	0.00	240		
AA2:BB2:CC3	0.0	0.00	240		
AA2:BB2:CC4	0.0	0.00	240		
AA2:BB3:CC1	0.0	0.00	240		
AA2:BB3:CC2	0.0	0.00	240		
AA2:BB3:CC3	0.0	0.00	240		
AA2:BB3:CC4	0.0	0.00	240		
AA2:BB4:CC1	0.0	0.00	240		
AA2:BB4:CC2	0.0	0.00	240		
AA2:BB4:CC3	0.0	0.00	240		
AA2:BB4:CC4	0.0	0.00	240		
AA2:BB5:CC1	0.0	0.00	240		
AA2:BB5:CC2	0.0	0.00	240		
AA2:BB5:CC3	0.0	0.00	240		
AA2:BB5:CC4	0.0	0.00	240		
Site1:CC1	31.3	801.12	240	0.0391	0.9688336
Site1:CC2	26.7	801.12	240	0.0333	0.9734735
Site1:CC3	26.7	801.12	240	0.0333	0.9734735
Site1:CC4	0.0	0.00	240		
Site2:CC1	-29.0	801.12	240	-0.0362	0.9711534
Site2:CC2	-72.3	801.12	240	-0.0903	0.9281316
Site2:CC3	-10.3	801.12	240	-0.0129	0.9897194
Site2:CC4	0.0	0.00	240		
Site3:CC1	1.7	801.12	240	0.0021	0.9983418
Site3:CC2	-7.0	801.12	240	-0.0087	0.9930356
Site3:CC3	-15.7	801.12	240	-0.0196	0.9844138
Site3:CC4	0.0	0.00	240		
Site4:CC1	0.0	0.00	240		

Site4:CC2	0.0	0.00	240		
Site4:CC3	0.0	0.00	240		
Site4:CC4	0.0	0.00	240		
Site1:AA1:CC1	-10.0	1132.95	240	-0.0088	0.9929649
Site1:AA1:CC2	-15.0	1132.95	240	-0.0132	0.9894475
Site1:AA1:CC3	-29.0	1132.95	240	-0.0256	0.9796001
Site1:AA1:CC4	0.0	0.00	240		
Site1:AA2:CC1	0.0	0.00	240		
Site1:AA2:CC2	0.0	0.00	240		
Site1:AA2:CC3	0.0	0.00	240		
Site1:AA2:CC4	0.0	0.00	240		
Site2:AA1:CC1	62.0	1132.95	240	0.0547	0.9564036
Site2:AA1:CC2	156.7	1132.95	240	0.1383	0.8901335
Site2:AA1:CC3	-20.7	1132.95	240	-0.0182	0.9854614
Site2:AA1:CC4	0.0	0.00	240		
Site2:AA2:CC1	0.0	0.00	240		
Site2:AA2:CC2	0.0	0.00	240		
Site2:AA2:CC3	0.0	0.00	240		
Site2:AA2:CC4	0.0	0.00	240		
Site3:AA1:CC1	-48.0	1132.95	240	-0.0424	0.9662412
Site3:AA1:CC2	9.0	1132.95	240	0.0079	0.9936684
Site3:AA1:CC3	48.7	1132.95	240	0.0430	0.9657726
Site3:AA1:CC4	0.0	0.00	240		
Site3:AA2:CC1	0.0	0.00	240		
Site3:AA2:CC2	0.0	0.00	240		
Site3:AA2:CC3	0.0	0.00	240		
Site3:AA2:CC4	0.0	0.00	240		
Site4:AA1:CC1	0.0	0.00	240		
Site4:AA1:CC2	0.0	0.00	240		
Site4:AA1:CC3	0.0	0.00	240		
Site4:AA1:CC4	0.0	0.00	240		
Site4:AA2:CC1	0.0	0.00	240		
Site4:AA2:CC2	0.0	0.00	240		
Site4:AA2:CC3	0.0	0.00	240		
Site4:AA2:CC4	0.0	0.00	240		
Site1:BB1:CC1	-6.0	1132.95	240	-0.0053	0.9957789
Site1:BB1:CC2	-62.0	1132.95	240	-0.0547	0.9564036
Site1:BB1:CC3	6.3	1132.95	240	0.0056	0.9955444
Site1:BB1:CC4	0.0	0.00	240		
Site1:BB2:CC1	61.0	1132.95	240	0.0538	0.9571061
Site1:BB2:CC2	-57.0	1132.95	240	-0.0503	0.9599163
Site1:BB2:CC3	-38.0	1132.95	240	-0.0335	0.9732713
Site1:BB2:CC4	0.0	0.00	240		
Site1:BB3:CC1	-85.7	1132.95	240	-0.0756	0.9397894
Site1:BB3:CC2	-116.0	1132.95	240	-0.1024	0.9185346
Site1:BB3:CC3	-108.3	1132.95	240	-0.0956	0.9239018
Site1:BB3:CC4	0.0	0.00	240		
Site1:BB4:CC1	-74.7	1132.95	240	-0.0659	0.9475086

Site1:BB4:CC2	-36.7	1132.95	240	-0.0324	0.9742088
Site1:BB4:CC3	-138.3	1132.95	240	-0.1221	0.9029220
Site1:BB4:CC4	0.0	0.00	240		
Site1:BB5:CC1	0.0	0.00	240		
Site1:BB5:CC2	0.0	0.00	240		
Site1:BB5:CC3	0.0	0.00	240		
Site1:BB5:CC4	0.0	0.00	240		
Site2:BB1:CC1	59.3	1132.95	240	0.0524	0.9582769
Site2:BB1:CC2	43.0	1132.95	240	0.0380	0.9697559
Site2:BB1:CC3	18.7	1132.95	240	0.0165	0.9868682
Site2:BB1:CC4	0.0	0.00	240		
Site2:BB2:CC1	54.3	1132.95	240	0.0480	0.9617901
Site2:BB2:CC2	95.3	1132.95	240	0.0841	0.9330104
Site2:BB2:CC3	-54.0	1132.95	240	-0.0477	0.9620243
Site2:BB2:CC4	0.0	0.00	240		
Site2:BB3:CC1	-55.3	1132.95	240	-0.0488	0.9610874
Site2:BB3:CC2	81.3	1132.95	240	0.0718	0.9428297
Site2:BB3:CC3	-2.3	1132.95	240	-0.0021	0.9983585
Site2:BB3:CC4	0.0	0.00	240		
Site2:BB4:CC1	-32.0	1132.95	240	-0.0282	0.9774904
Site2:BB4:CC2	13.0	1132.95	240	0.0115	0.9908544
Site2:BB4:CC3	-63.0	1132.95	240	-0.0556	0.9557011
Site2:BB4:CC4	0.0	0.00	240		
Site2:BB5:CC1	0.0	0.00	240		
Site2:BB5:CC2	0.0	0.00	240		
Site2:BB5:CC3	0.0	0.00	240		
Site2:BB5:CC4	0.0	0.00	240		
Site3:BB1:CC1	39.3	1132.95	240	0.0347	0.9723338
Site3:BB1:CC2	19.0	1132.95	240	0.0168	0.9866337
Site3:BB1:CC3	19.3	1132.95	240	0.0171	0.9863993
Site3:BB1:CC4	0.0	0.00	240		
Site3:BB2:CC1	73.3	1132.95	240	0.0647	0.9484447
Site3:BB2:CC2	-66.0	1132.95	240	-0.0583	0.9535940
Site3:BB2:CC3	-28.3	1132.95	240	-0.0250	0.9800690
Site3:BB2:CC4	0.0	0.00	240		
Site3:BB3:CC1	1.3	1132.95	240	0.0012	0.9990620
Site3:BB3:CC2	-49.0	1132.95	240	-0.0432	0.9655383
Site3:BB3:CC3	26.7	1132.95	240	0.0235	0.9812412
Site3:BB3:CC4	0.0	0.00	240		
Site3:BB4:CC1	-61.0	1132.95	240	-0.0538	0.9571061
Site3:BB4:CC2	-65.7	1132.95	240	-0.0580	0.9538281
Site3:BB4:CC3	-103.7	1132.95	240	-0.0915	0.9271704
Site3:BB4:CC4	0.0	0.00	240		
Site3:BB5:CC1	0.0	0.00	240		
Site3:BB5:CC2	0.0	0.00	240		
Site3:BB5:CC3	0.0	0.00	240		
Site3:BB5:CC4	0.0	0.00	240		
Site4:BB1:CC1	0.0	0.00	240		

Site4:BB1:CC2	0.0	0.00	240		
Site4:BB1:CC3	0.0	0.00	240		
Site4:BB1:CC4	0.0	0.00	240		
Site4:BB2:CC1	0.0	0.00	240		
Site4:BB2:CC2	0.0	0.00	240		
Site4:BB2:CC3	0.0	0.00	240		
Site4:BB2:CC4	0.0	0.00	240		
Site4:BB3:CC1	0.0	0.00	240		
Site4:BB3:CC2	0.0	0.00	240		
Site4:BB3:CC3	0.0	0.00	240		
Site4:BB3:CC4	0.0	0.00	240		
Site4:BB4:CC1	0.0	0.00	240		
Site4:BB4:CC2	0.0	0.00	240		
Site4:BB4:CC3	0.0	0.00	240		
Site4:BB4:CC4	0.0	0.00	240		
Site4:BB5:CC1	0.0	0.00	240		
Site4:BB5:CC2	0.0	0.00	240		
Site4:BB5:CC3	0.0	0.00	240		
Site4:BB5:CC4	0.0	0.00	240		
Site1:AA1:BB1:CC1	-66.7	1602.23	240	-0.0416	0.9668453
Site1:AA1:BB1:CC2	-16.3	1602.23	240	-0.0102	0.9918749
Site1:AA1:BB1:CC3	-86.0	1602.23	240	-0.0537	0.9572387
Site1:AA1:BB1:CC4	0.0	0.00	240		
Site1:AA1:BB2:CC1	-31.0	1602.23	240	-0.0193	0.9845796
Site1:AA1:BB2:CC2	81.3	1602.23	240	0.0508	0.9595570
Site1:AA1:BB2:CC3	58.3	1602.23	240	0.0364	0.9709877
Site1:AA1:BB2:CC4	0.0	0.00	240		
Site1:AA1:BB3:CC1	-103.3	1602.23	240	-0.0645	0.9486311
Site1:AA1:BB3:CC2	-3.7	1602.23	240	-0.0023	0.9981760
Site1:AA1:BB3:CC3	45.3	1602.23	240	0.0283	0.9774513
Site1:AA1:BB3:CC4	0.0	0.00	240		
Site1:AA1:BB4:CC1	137.3	1602.23	240	0.0857	0.9317655
Site1:AA1:BB4:CC2	69.3	1602.23	240	0.0433	0.9655200
Site1:AA1:BB4:CC3	137.0	1602.23	240	0.0855	0.9319307
Site1:AA1:BB4:CC4	0.0	0.00	240		
Site1:AA1:BB5:CC1	0.0	0.00	240		
Site1:AA1:BB5:CC2	0.0	0.00	240		
Site1:AA1:BB5:CC3	0.0	0.00	240		
Site1:AA1:BB5:CC4	0.0	0.00	240		
Site1:AA2:BB1:CC1	0.0	0.00	240		
Site1:AA2:BB1:CC2	0.0	0.00	240		
Site1:AA2:BB1:CC3	0.0	0.00	240		
Site1:AA2:BB1:CC4	0.0	0.00	240		
Site1:AA2:BB2:CC1	0.0	0.00	240		
Site1:AA2:BB2:CC2	0.0	0.00	240		
Site1:AA2:BB2:CC3	0.0	0.00	240		
Site1:AA2:BB2:CC4	0.0	0.00	240		
Site1:AA2:BB3:CC1	0.0	0.00	240		

Site1:AA2:BB3:CC2	0.0	0.00	240		
Site1:AA2:BB3:CC3	0.0	0.00	240		
Site1:AA2:BB3:CC4	0.0	0.00	240		
Site1:AA2:BB4:CC1	0.0	0.00	240		
Site1:AA2:BB4:CC2	0.0	0.00	240		
Site1:AA2:BB4:CC3	0.0	0.00	240		
Site1:AA2:BB4:CC4	0.0	0.00	240		
Site1:AA2:BB5:CC1	0.0	0.00	240		
Site1:AA2:BB5:CC2	0.0	0.00	240		
Site1:AA2:BB5:CC3	0.0	0.00	240		
Site1:AA2:BB5:CC4	0.0	0.00	240		
Site2:AA1:BB1:CC1	-130.0	1602.23	240	-0.0811	0.9354009
Site2:AA1:BB1:CC2	-79.0	1602.23	240	-0.0493	0.9607163
Site2:AA1:BB1:CC3	17.7	1602.23	240	0.0110	0.9912116
Site2:AA1:BB1:CC4	0.0	0.00	240		
Site2:AA1:BB2:CC1	-128.0	1602.23	240	-0.0799	0.9363925
Site2:AA1:BB2:CC2	-92.0	1602.23	240	-0.0574	0.9542585
Site2:AA1:BB2:CC3	160.3	1602.23	240	0.1001	0.9203734
Site2:AA1:BB2:CC4	0.0	0.00	240		
Site2:AA1:BB3:CC1	-49.0	1602.23	240	-0.0306	0.9756281
Site2:AA1:BB3:CC2	-220.3	1602.23	240	-0.1375	0.8907380
Site2:AA1:BB3:CC3	51.3	1602.23	240	0.0320	0.9744679
Site2:AA1:BB3:CC4	0.0	0.00	240		
Site2:AA1:BB4:CC1	60.7	1602.23	240	0.0379	0.9698278
Site2:AA1:BB4:CC2	-81.7	1602.23	240	-0.0510	0.9593914
Site2:AA1:BB4:CC3	37.7	1602.23	240	0.0235	0.9812639
Site2:AA1:BB4:CC4	0.0	0.00	240		
Site2:AA1:BB5:CC1	0.0	0.00	240		
Site2:AA1:BB5:CC2	0.0	0.00	240		
Site2:AA1:BB5:CC3	0.0	0.00	240		
Site2:AA1:BB5:CC4	0.0	0.00	240		
Site2:AA2:BB1:CC1	0.0	0.00	240		
Site2:AA2:BB1:CC2	0.0	0.00	240		
Site2:AA2:BB1:CC3	0.0	0.00	240		
Site2:AA2:BB1:CC4	0.0	0.00	240		
Site2:AA2:BB2:CC1	0.0	0.00	240		
Site2:AA2:BB2:CC2	0.0	0.00	240		
Site2:AA2:BB2:CC3	0.0	0.00	240		
Site2:AA2:BB2:CC4	0.0	0.00	240		
Site2:AA2:BB3:CC1	0.0	0.00	240		
Site2:AA2:BB3:CC2	0.0	0.00	240		
Site2:AA2:BB3:CC3	0.0	0.00	240		
Site2:AA2:BB3:CC4	0.0	0.00	240		
Site2:AA2:BB4:CC1	0.0	0.00	240		
Site2:AA2:BB4:CC2	0.0	0.00	240		
Site2:AA2:BB4:CC3	0.0	0.00	240		
Site2:AA2:BB4:CC4	0.0	0.00	240		
Site2:AA2:BB5:CC1	0.0	0.00	240		

Site2:AA2:BB5:CC2	0.0	0.00	240		
Site2:AA2:BB5:CC3	0.0	0.00	240		
Site2:AA2:BB5:CC4	0.0	0.00	240		
Site3:AA1:BB1:CC1	60.7	1602.23	240	0.0379	0.9698278
Site3:AA1:BB1:CC2	-3.3	1602.23	240	-0.0021	0.9983418
Site3:AA1:BB1:CC3	-8.3	1602.23	240	-0.0052	0.9958545
Site3:AA1:BB1:CC4	0.0	0.00	240		
Site3:AA1:BB2:CC1	-47.3	1602.23	240	-0.0295	0.9764568
Site3:AA1:BB2:CC2	138.0	1602.23	240	0.0861	0.9314351
Site3:AA1:BB2:CC3	44.3	1602.23	240	0.0277	0.9779486
Site3:AA1:BB2:CC4	0.0	0.00	240		
Site3:AA1:BB3:CC1	-51.7	1602.23	240	-0.0322	0.9743022
Site3:AA1:BB3:CC2	-49.0	1602.23	240	-0.0306	0.9756281
Site3:AA1:BB3:CC3	-70.7	1602.23	240	-0.0441	0.9648573
Site3:AA1:BB3:CC4	0.0	0.00	240		
Site3:AA1:BB4:CC1	114.0	1602.23	240	0.0712	0.9433371
Site3:AA1:BB4:CC2	45.0	1602.23	240	0.0281	0.9776171
Site3:AA1:BB4:CC3	19.7	1602.23	240	0.0123	0.9902168
Site3:AA1:BB4:CC4	0.0	0.00	240		
Site3:AA1:BB5:CC1	0.0	0.00	240		
Site3:AA1:BB5:CC2	0.0	0.00	240		
Site3:AA1:BB5:CC3	0.0	0.00	240		
Site3:AA1:BB5:CC4	0.0	0.00	240		
Site3:AA2:BB1:CC1	0.0	0.00	240		
Site3:AA2:BB1:CC2	0.0	0.00	240		
Site3:AA2:BB1:CC3	0.0	0.00	240		
Site3:AA2:BB1:CC4	0.0	0.00	240		
Site3:AA2:BB2:CC1	0.0	0.00	240		
Site3:AA2:BB2:CC2	0.0	0.00	240		
Site3:AA2:BB2:CC3	0.0	0.00	240		
Site3:AA2:BB2:CC4	0.0	0.00	240		
Site3:AA2:BB3:CC1	0.0	0.00	240		
Site3:AA2:BB3:CC2	0.0	0.00	240		
Site3:AA2:BB3:CC3	0.0	0.00	240		
Site3:AA2:BB3:CC4	0.0	0.00	240		
Site3:AA2:BB4:CC1	0.0	0.00	240		
Site3:AA2:BB4:CC2	0.0	0.00	240		
Site3:AA2:BB4:CC3	0.0	0.00	240		
Site3:AA2:BB4:CC4	0.0	0.00	240		
Site3:AA2:BB5:CC1	0.0	0.00	240		
Site3:AA2:BB5:CC2	0.0	0.00	240		
Site3:AA2:BB5:CC3	0.0	0.00	240		
Site3:AA2:BB5:CC4	0.0	0.00	240		
Site4:AA1:BB1:CC1	0.0	0.00	240		
Site4:AA1:BB1:CC2	0.0	0.00	240		
Site4:AA1:BB1:CC3	0.0	0.00	240		
Site4:AA1:BB1:CC4	0.0	0.00	240		
Site4:AA1:BB2:CC1	0.0	0.00	240		

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

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

(74) MODEL

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

\$ANOVA

Response : height

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

\$`Type I`

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

\$`Type II`

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

\$`Type III`

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

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

\$Parameter

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

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

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

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

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

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

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

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

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

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

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

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

(75) MODEL

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

\$ANOVA

Response : height

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

\$`Type I`

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

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

\$`Type II`

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

\$`Type III`

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

\$Parameter

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

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

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

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

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

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

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

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

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

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

```
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
```

```
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

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

\$ANOVA

Response : yield

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	26	44017	1692.97	9.5603	4.779e-11 ***
RESIDUALS	45	7969	177.08		
CORRECTED TOTAL	71	51986			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	5	15875.3	3175.1	17.9297	9.525e-10 ***
var	2	1786.4	893.2	5.0438	0.010557 *
rep:var	10	6013.3	601.3	3.3957	0.002251 **
nit	3	20020.5	6673.5	37.6856	2.458e-12 ***
var:nit	6	321.7	53.6	0.3028	0.932199

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

\$`Type II`

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

```
rep:var 10 6013.3 601.3 3.3957 0.002251 **
nit      3 20020.5 6673.5 37.6856 2.458e-12 ***
var:nit  6  321.7   53.6 0.3028 0.932199
```

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	5	15875.3	3175.1	17.9297	9.525e-10 ***
var	2	1786.4	893.2	5.0438	0.010557 *
rep:var 10	6013.3	601.3	3.3957	0.002251 **	
nit	3	20020.5	6673.5	37.6856	2.458e-12 ***
var:nit 6	321.7	53.6	0.3028	0.932199	

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	85.875	8.1490	45	10.5381	9.814e-14 ***
rep1	20.750	9.4097	45	2.2052	0.0325933 *
rep2	-14.000	9.4097	45	-1.4878	0.1437694
rep3	12.250	9.4097	45	1.3019	0.1995913
rep4	-23.750	9.4097	45	-2.5240	0.0152008 *
rep5	9.500	9.4097	45	1.0096	0.3180846
rep6	0.000	0.0000	45		
var1	-22.500	11.5244	45	-1.9524	0.0571318 .
var2	-20.125	11.5244	45	-1.7463	0.0875843 .
var3	0.000	0.0000	45		
rep1:var1	32.750	13.3073	45	2.4611	0.0177533 *
rep1:var2	22.250	13.3073	45	1.6720	0.1014609
rep1:var3	0.000	0.0000	45		
rep2:var1	16.000	13.3073	45	1.2024	0.2355164
rep2:var2	31.750	13.3073	45	2.3859	0.0213053 *
rep2:var3	0.000	0.0000	45		
rep3:var1	-14.500	13.3073	45	-1.0896	0.2816769
rep3:var2	10.750	13.3073	45	0.8078	0.4234387
rep3:var3	0.000	0.0000	45		
rep4:var1	26.250	13.3073	45	1.9726	0.0547034 .
rep4:var2	29.000	13.3073	45	2.1793	0.0345870 *
rep4:var3	0.000	0.0000	45		
rep5:var1	-16.500	13.3073	45	-1.2399	0.2214304
rep5:var2	-13.000	13.3073	45	-0.9769	0.3338365
rep5:var3	0.000	0.0000	45		
rep6:var1	0.000	0.0000	45		
rep6:var2	0.000	0.0000	45		
rep6:var3	0.000	0.0000	45		
nit1	21.833	7.6830	45	2.8418	0.0067187 **
nit2	30.500	7.6830	45	3.9698	0.0002562 ***


```

nit3      40.167      7.6830 45  5.2280 4.290e-06 ***
nit4       0.000      0.0000 45
var1:nit1  -3.667     10.8653 45 -0.3375 0.7373358
var1:nit2   8.833     10.8653 45  0.8130 0.4205085
var1:nit3   6.833     10.8653 45  0.6289 0.5325868
var1:nit4   0.000      0.0000 45
var2:nit1  -3.333     10.8653 45 -0.3068 0.7604214
var2:nit2   4.167     10.8653 45  0.3835 0.7031679
var2:nit3   4.667     10.8653 45  0.4295 0.6696087
var2:nit4   0.000      0.0000 45
var3:nit1   0.000      0.0000 45
var3:nit2   0.000      0.0000 45
var3:nit3   0.000      0.0000 45
var3:nit4   0.000      0.0000 45

```

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

(77) MODEL

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

\$ANOVA

Response : yield

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	37	48090	1299.7	11.341	6.734e-11 ***
RESIDUALS	34	3896	114.6		
CORRECTED TOTAL	71	51986			

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

\$`Type I`

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

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

\$`Type II`

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

```

nit      3 12559.3  4186.4 36.5308 9.683e-11 ***
var:nit  6   477.8    79.6  0.6949 0.6553307
row      9   945.0   105.0  0.9162 0.5230151
col      2  3171.5  1585.7 13.8373 4.012e-05 ***

```

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

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	2	5942.5	2971.3	25.9273	1.449e-07 ***
var	2	2799.8	1399.9	12.2155	0.0001005 ***
rep:var	4	997.8	249.4	2.1767	0.0926008 .
nit	3	11977.9	3992.6	34.8397	1.775e-10 ***
var:nit	6	477.8	79.6	0.6949	0.6553307
row	9	945.0	105.0	0.9162	0.5230151
col	2	3171.5	1585.7	13.8373	4.012e-05 ***

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	78.195	9.4953	34	8.2351	1.311e-09 ***
rep1	22.320	11.2116	34	1.9908	0.0545890 .
rep2	-9.827	9.9492	34	-0.9877	0.3302882
rep3	16.942	10.2780	34	1.6484	0.1084805
rep4	-24.656	10.6082	34	-2.3242	0.0262249 *
rep5	16.807	10.1264	34	1.6597	0.1061670
rep6	0.000	0.0000	34		
var1	-23.629	12.0789	34	-1.9562	0.0586954 .
var2	-16.007	11.9933	34	-1.3346	0.1908629
var3	0.000	0.0000	34		
rep1:var1	39.666	14.2816	34	2.7775	0.0088510 **
rep1:var2	24.703	14.1608	34	1.7445	0.0901108 .
rep1:var3	0.000	0.0000	34		
rep2:var1	8.452	13.6932	34	0.6172	0.5411868
rep2:var2	35.142	13.4753	34	2.6079	0.0134358 *
rep2:var3	0.000	0.0000	34		
rep3:var1	-15.615	15.0163	34	-1.0399	0.3057408
rep3:var2	5.214	14.8157	34	0.3519	0.7270537
rep3:var3	0.000	0.0000	34		
rep4:var1	32.022	14.0835	34	2.2737	0.0294152 *
rep4:var2	32.597	14.2110	34	2.2938	0.0281056 *
rep4:var3	0.000	0.0000	34		
rep5:var1	-29.657	14.2036	34	-2.0880	0.0443605 *
rep5:var2	-20.826	14.0023	34	-1.4873	0.1461435
rep5:var3	0.000	0.0000	34		
rep6:var1	0.000	0.0000	34		

```

rep6:var2      0.000      0.0000 34
rep6:var3      0.000      0.0000 34
nit1           20.904      6.8122 34  3.0686 0.0042045 **
nit2           25.790      7.9006 34  3.2643 0.0025052 **
nit3           43.888      8.4402 34  5.1999 9.452e-06 ***
nit4           0.000      0.0000 34
var1:nit1      1.136      9.7632 34  0.1164 0.9080219
var1:nit2     14.232     10.2550 34  1.3878 0.1742328
var1:nit3     -3.260     11.0914 34 -0.2939 0.7705879
var1:nit4      0.000      0.0000 34
var2:nit1     -1.428      9.1191 34 -0.1566 0.8764628
var2:nit2      5.784     11.0936 34  0.5214 0.6054692
var2:nit3     -6.461     11.3313 34 -0.5702 0.5722670
var2:nit4      0.000      0.0000 34
var3:nit1      0.000      0.0000 34
var3:nit2      0.000      0.0000 34
var3:nit3      0.000      0.0000 34
var3:nit4      0.000      0.0000 34
row1           1.613      9.9332 34  0.1624 0.8719639
row2           0.000      0.0000 34
row3          -10.016      8.3602 34 -1.1980 0.2391928
row4           0.000      0.0000 34
row5          -7.727      8.5301 34 -0.9059 0.3713775
row6           0.000      0.0000 34
row7          -3.594      8.6347 34 -0.4162 0.6798797
row8           0.000      0.0000 34
row9          13.706      8.4538 34  1.6213 0.1141882
row10          0.000      0.0000 34
row11         -14.812      8.7800 34 -1.6870 0.1007506
row12          0.000      0.0000 34
row13          2.006      8.3976 34  0.2389 0.8126419
row14          0.000      0.0000 34
row15         -4.632      8.4677 34 -0.5470 0.5879538
row16          0.000      0.0000 34
row17         -0.198      8.7515 34 -0.0226 0.9820790
row18          0.000      0.0000 34
col1           11.566      3.9157 34  2.9538 0.0056610 **
col2           0.000      0.0000 34
col3           16.517      4.1675 34  3.9633 0.0003597 ***
col4           0.000      0.0000 34

```

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

```

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

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

\$ANOVA

Response : height

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	199	1710.2	8.5937		
RESIDUALS	0	0.0			
CORRECTED TOTAL	199	1710.2			

\$`Type I`

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

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

\$`Type II`

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

\$`Type III`

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	8		0		
P1	-2		0		
P2	0		0		
column1	0		0		
column2	0		0		

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

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

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

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

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

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

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

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

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

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

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

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

(79) MODEL

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

\$ANOVA

Response : height

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	199	1710.2	8.5937		
RESIDUALS	0	0.0			
CORRECTED TOTAL	199	1710.2			

\$`Type I`

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

\$`Type II`

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

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

```
$`Type III`
```

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

```
$Parameter
```

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

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

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

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

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

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

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

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

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

7.7 Example 5.1

(80) MODEL

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

\$ANOVA

Response : Y

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

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

\$`Type I`

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

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

\$`Type II`

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

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

\$`Type III`

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

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	8.0833	0.86156	15	9.3822	1.149e-07 ***
R1	-0.5417	0.67056	15	-0.8078	0.4318411
R2	-0.1250	0.62082	15	-0.2013	0.8431323
R3	0.0000	0.00000	15		

A1	-0.4167	0.67056	15	-0.6214	0.5436847
A2	0.0000	0.00000	15		
R1:A1	0.4375	0.98160	15	0.4457	0.6621795
R1:A2	0.0000	0.00000	15		
R2:A1	-3.7292	0.91382	15	-4.0808	0.0009837 ***
R2:A2	0.0000	0.00000	15		
R3:A1	0.0000	0.00000	15		
R3:A2	0.0000	0.00000	15		
C1	0.5000	0.58531	15	0.8542	0.4064073
C2	0.3333	0.58531	15	0.5695	0.5774500
C3	0.0000	0.00000	15		
B1	0.1250	1.03470	15	0.1208	0.9054464
B2	0.0000	0.00000	15		
C1:B1	-0.5000	0.82776	15	-0.6040	0.5548431
C1:B2	0.0000	0.00000	15		
C2:B1	-0.1667	0.82776	15	-0.2013	0.8431323
C2:B2	0.0000	0.00000	15		
C3:B1	0.0000	0.00000	15		
C3:B2	0.0000	0.00000	15		
Tx1	-5.4792	0.89008	15	-6.1558	1.839e-05 ***
Tx2	-2.7083	0.85323	15	-3.1742	0.0062873 **
Tx3	-1.2292	0.89008	15	-1.3810	0.1875206
Tx4	-0.9167	0.89008	15	-1.0299	0.3193930
Tx5	-2.2917	0.89008	15	-2.5747	0.0211374 *
Tx6	0.0000	0.00000	15		
B1:Tx1	1.6250	1.34112	15	1.2117	0.2443809
B1:Tx2	-0.2500	1.24164	15	-0.2013	0.8431323
B1:Tx3	1.1250	1.34112	15	0.8388	0.4147227
B1:Tx4	1.5000	1.34112	15	1.1185	0.2809609
B1:Tx5	-0.7500	1.34112	15	-0.5592	0.5842567
B1:Tx6	0.0000	0.00000	15		
B2:Tx1	0.0000	0.00000	15		
B2:Tx2	0.0000	0.00000	15		
B2:Tx3	0.0000	0.00000	15		
B2:Tx4	0.0000	0.00000	15		
B2:Tx5	0.0000	0.00000	15		
B2:Tx6	0.0000	0.00000	15		

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

(81) MODEL

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

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
--	----	--------	---------	---------	--------

```

MODEL          20 194.188  9.7094  9.8323 2.254e-05 ***
RESIDUALS       15  14.813  0.9875
CORRECTED TOTAL 35 209.000

```

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

\$`Type I`

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

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

\$`Type II`

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

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

\$`Type III`

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

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)	
(Intercept)	7.7083	0.84451	15	9.1276	1.638e-07	***

R1	-0.3333	0.57373	15	-0.5810	0.569873	
R2	-0.1667	0.57373	15	-0.2905	0.775414	
R3	0.0000	0.00000	15			
A1	0.2292	1.01422	15	0.2260	0.824288	
A2	0.0000	0.00000	15			
R1:A1	-0.3333	0.81138	15	-0.4108	0.687010	
R1:A2	0.0000	0.00000	15			
R2:A1	-4.1667	0.81138	15	-5.1353	0.000122	***
R2:A2	0.0000	0.00000	15			
R3:A1	0.0000	0.00000	15			
R3:A2	0.0000	0.00000	15			
C1	0.0625	0.65729	15	0.0951	0.925504	
C2	0.4375	0.60853	15	0.7189	0.483227	
C3	0.0000	0.00000	15			
B1	0.5938	0.65729	15	0.9033	0.380630	
B2	0.0000	0.00000	15			
C1:B1	-0.0625	0.89574	15	-0.0698	0.945294	
C1:B2	0.0000	0.00000	15			
C2:B1	-0.1563	0.89574	15	-0.1744	0.863854	
C2:B2	0.0000	0.00000	15			
C3:B1	0.0000	0.00000	15			
C3:B2	0.0000	0.00000	15			
Tx1	-4.8854	0.87247	15	-5.5995	5.070e-05	***
Tx2	-2.5208	0.83635	15	-3.0141	0.008719	**
Tx3	-0.8854	0.87247	15	-1.0148	0.326271	
Tx4	0.7083	0.87247	15	0.8119	0.429560	
Tx5	-3.2292	0.87247	15	-3.7012	0.002134	**
Tx6	0.0000	0.00000	15			
A1:Tx1	0.4375	1.31458	15	0.3328	0.743887	
A1:Tx2	-0.6250	1.21707	15	-0.5135	0.615061	
A1:Tx3	0.4375	1.31458	15	0.3328	0.743887	
A1:Tx4	-1.7500	1.31458	15	-1.3312	0.202996	
A1:Tx5	1.1250	1.31458	15	0.8558	0.405580	
A1:Tx6	0.0000	0.00000	15			
A2:Tx1	0.0000	0.00000	15			
A2:Tx2	0.0000	0.00000	15			
A2:Tx3	0.0000	0.00000	15			
A2:Tx4	0.0000	0.00000	15			
A2:Tx5	0.0000	0.00000	15			
A2:Tx6	0.0000	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 Std. Error Df t value Pr(>|t|)
(Intercept)   7.9545     0.98427 11  8.0817 5.93e-06 ***
R1            -0.6318     0.73222 11 -0.8629 0.4066247
R2            -0.1636     0.66557 11 -0.2459 0.8103184
R3             0.0000     0.00000 11
A1             0.2273     1.10928 11  0.2049 0.8414057
A2             0.0000     0.00000 11
R1:A1          0.4636     1.09010 11  0.4253 0.6788082
R1:A2          0.0000     0.00000 11
R2:A1         -3.7682     0.98951 11 -3.8081 0.0029022 **
R2:A2          0.0000     0.00000 11
R3:A1          0.0000     0.00000 11
R3:A2          0.0000     0.00000 11
C1             0.2682     0.73222 11  0.3663 0.7211200
C2             0.4364     0.66557 11  0.6556 0.5255407
C3             0.0000     0.00000 11
B1            -0.2409     1.17470 11 -0.2051 0.8412545
B2             0.0000     0.00000 11
C1:B1         -0.2318     0.98951 11 -0.2343 0.8190745
C1:B2          0.0000     0.00000 11
C2:B1          0.0318     0.98951 11  0.0322 0.9749241
C2:B2          0.0000     0.00000 11
C3:B1          0.0000     0.00000 11
C3:B2          0.0000     0.00000 11
Tx1           -5.3485     1.04397 11 -5.1232 0.0003318 ***
Tx2           -2.5152     1.00973 11 -2.4909 0.0299872 *
Tx3           -1.1667     1.04397 11 -1.1175 0.2875828
Tx4            0.2424     1.22954 11  0.1972 0.8472929
Tx5           -2.6167     1.17171 11 -2.2332 0.0472599 *
Tx6            0.0000     0.00000 11
A1:Tx1        -0.4182     1.59983 11 -0.2614 0.7986202
A1:Tx2        -0.6182     1.42305 11 -0.4344 0.6723913
A1:Tx3        -0.2000     1.59983 11 -0.1250 0.9027684
A1:Tx4        -2.0091     1.51170 11 -1.3290 0.2107461
A1:Tx5        -0.1000     1.98612 11 -0.0503 0.9607465
A1:Tx6         0.0000     0.00000 11
A2:Tx1         0.0000     0.00000 11
A2:Tx2         0.0000     0.00000 11
A2:Tx3         0.0000     0.00000 11
A2:Tx4         0.0000     0.00000 11
A2:Tx5         0.0000     0.00000 11
A2:Tx6         0.0000     0.00000 11
B1:Tx1         1.7818     1.59983 11  1.1138 0.2891291
B1:Tx2        -0.0182     1.42305 11 -0.0128 0.9900347
```


B1:Tx3	1.2000	1.59983	11	0.7501	0.4689466
B1:Tx4	1.1909	1.51170	11	0.7878	0.4474596
B1:Tx5	0.0000	0.00000	11		
B1:Tx6	0.0000	0.00000	11		
B2:Tx1	0.0000	0.00000	11		
B2:Tx2	0.0000	0.00000	11		
B2:Tx3	0.0000	0.00000	11		
B2:Tx4	0.0000	0.00000	11		
B2:Tx5	0.0000	0.00000	11		
B2:Tx6	0.0000	0.00000	11		

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

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

Model :

$Y \sim R + A + A:R + C + B + B:C + Tx + A:Tx + B:Tx$

Complete :

	(Intercept)	R1	R2	A1	C1	C2	B1	Tx1	Tx2	Tx3	Tx4	Tx5	R1:A1
B1:Tx5	0		0	-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												

```
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	Std. Error	Df	t value	Pr(> t)
(Intercept)	8.5833	0.86189	7	9.9587	2.199e-05 ***
R1	-1.2833	0.79282	7	-1.6187	0.1495477
R2	-0.0500	0.55549	7	-0.0900	0.9308004
R3	0.0000	0.00000	7		
A1	-0.5833	0.98561	7	-0.5918	0.5725621
A2	0.0000	0.00000	7		
R1:A1	1.7250	1.00570	7	1.7152	0.1300172
R1:A2	0.0000	0.00000	7		
R2:A1	-3.4083	1.01136	7	-3.3700	0.0119197 *
R2:A2	0.0000	0.00000	7		
R3:A1	0.0000	0.00000	7		
R3:A2	0.0000	0.00000	7		
C1	-0.3833	0.79282	7	-0.4835	0.6434958
C2	0.5500	0.55549	7	0.9901	0.3551012
C3	0.0000	0.00000	7		
B1	-0.4417	0.94112	7	-0.4693	0.6531236
B2	0.0000	0.00000	7		
C1:B1	0.2833	0.96806	7	0.2927	0.7782513
C1:B2	0.0000	0.00000	7		
C2:B1	-0.6917	0.82462	7	-0.8388	0.4293080
C2:B2	0.0000	0.00000	7		
C3:B1	0.0000	0.00000	7		
C3:B2	0.0000	0.00000	7		
Tx1	-5.8333	0.95618	7	-6.1006	0.0004908 ***
Tx2	-2.2500	0.92582	7	-2.4303	0.0454020 *
Tx3	-1.8333	0.95618	7	-1.9173	0.0967067 .
Tx4	2.0833	1.37321	7	1.5171	0.1730222
Tx5	-2.6167	0.90079	7	-2.9048	0.0228276 *
Tx6	0.0000	0.00000	7		
A1:Tx1	-0.2250	1.75173	7	-0.1284	0.9014099

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

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

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

Model :

$Y \sim R + A + A:R + C + B + C:B + Tx + A:Tx + B:Tx + A:B:Tx$

Complete :

	(Intercept)	R1	R2	A1	C1	C2	B1	Tx1	Tx2	Tx3	Tx4	Tx5
B1:Tx5	0		0	-1/5	0	0	-1/5	0	0	0	0	0
A1:B1:Tx5	-1/6		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
	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		0			
A1:B1:Tx5	0	0	0	0	0	0	0		0			
A1:B1:Tx6	-1/5	-1/5	4/5	1	-1	1	0		0			

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

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

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

R4:G26	0.0000	0.00000	24		
R4:G27	0.0000	0.00000	24		
R4:G28	0.0000	0.00000	24		
F1	0.0000	0.75691	24	0.0000	1.0000000
F2	0.0000	0.75691	24	0.0000	1.0000000
F3	0.0000	0.00000	24		
G1:F1	-5.0000	1.69251	24	-2.9542	0.0069174 **
G1:F2	-2.0000	1.69251	24	-1.1817	0.2489103
G1:F3	0.0000	0.00000	24		
G2:F1	-2.0000	1.69251	24	-1.1817	0.2489103
G2:F2	1.0000	1.69251	24	0.5908	0.5601518
G2:F3	0.0000	0.00000	24		
G3:F1	-2.0000	1.69251	24	-1.1817	0.2489103
G3:F2	1.0000	1.69251	24	0.5908	0.5601518
G3:F3	0.0000	0.00000	24		
G4:F1	1.0000	1.69251	24	0.5908	0.5601518
G4:F2	4.0000	1.69251	24	2.3634	0.0265504 *
G4:F3	0.0000	0.00000	24		
G5:F1	-2.0000	1.69251	24	-1.1817	0.2489103
G5:F2	0.0000	1.69251	24	0.0000	1.0000000
G5:F3	0.0000	0.00000	24		
G6:F1	0.0000	1.69251	24	0.0000	1.0000000
G6:F2	1.0000	1.69251	24	0.5908	0.5601518
G6:F3	0.0000	0.00000	24		
G7:F1	-2.0000	1.69251	24	-1.1817	0.2489103
G7:F2	-1.0000	1.69251	24	-0.5908	0.5601518
G7:F3	0.0000	0.00000	24		
G8:F1	-3.0000	1.69251	24	-1.7725	0.0890040 .
G8:F2	-2.0000	1.69251	24	-1.1817	0.2489103
G8:F3	0.0000	0.00000	24		
G9:F1	-1.0000	1.69251	24	-0.5908	0.5601518
G9:F2	0.0000	1.69251	24	0.0000	1.0000000
G9:F3	0.0000	0.00000	24		
G10:F1	-1.0000	1.69251	24	-0.5908	0.5601518
G10:F2	-1.0000	1.69251	24	-0.5908	0.5601518
G10:F3	0.0000	0.00000	24		
G11:F1	0.0000	1.69251	24	0.0000	1.0000000
G11:F2	0.0000	1.69251	24	0.0000	1.0000000
G11:F3	0.0000	0.00000	24		
G12:F1	-4.0000	1.69251	24	-2.3634	0.0265504 *
G12:F2	-2.0000	1.69251	24	-1.1817	0.2489103
G12:F3	0.0000	0.00000	24		
G13:F1	-2.0000	1.69251	24	-1.1817	0.2489103
G13:F2	-2.0000	1.69251	24	-1.1817	0.2489103
G13:F3	0.0000	0.00000	24		
G14:F1	-3.0000	1.69251	24	-1.7725	0.0890040 .
G14:F2	-2.0000	1.69251	24	-1.1817	0.2489103
G14:F3	0.0000	0.00000	24		

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

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

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

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

Anova Table (Type III tests)

Response: Y

	Sum Sq	Df	F values	Pr(>F)
R	0.000	0		
G	202.417	3	58.8848	3.258e-11 ***
F	50.505	2	22.0385	3.686e-06 ***
R:G	11.750	9	1.1394	0.3749
G:F	77.983	54	1.2603	0.2718
Residuals	27.500	24		

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

7.9 Example 7.2

(85) MODEL

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

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	99	538.70	5.4415	5.1892	1.286e-05 ***
RESIDUALS	24	25.17	1.0486		
CORRECTED TOTAL	123	563.87			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	73.255	24.4183	23.2863	2.752e-07 ***
T	3	32.000	10.6667	10.1722	0.0001645 ***
R:T	9	28.402	3.1558	3.0095	0.0149568 *
G	21	309.908	14.7575	14.0734	7.158e-09 ***
T:G	63	95.140	1.5102	1.4401	0.1617931

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

\$`Type II`

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

```

T      3  32.000 10.6667 10.1722 0.0001645 ***
R:T    9  10.854  1.2060  1.1501 0.3684706
G     21 309.908 14.7575 14.0734 7.158e-09 ***
T:G   63  95.140  1.5102  1.4401 0.1617931

```

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	4.229	1.4097	1.3444	0.283500
T	3	22.668	7.5559	7.2056	0.001299 **
R:T	9	10.854	1.2060	1.1501	0.368471
G	21	309.908	14.7575	14.0734	7.158e-09 ***
T:G	63	95.140	1.5102	1.4401	0.161793

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	7.0833	0.72409	24	9.7824	7.541e-10 ***
R1	-0.6667	0.83611	24	-0.7973	0.433068
R2	-0.3333	0.83611	24	-0.3987	0.693659
R3	-1.3333	0.83611	24	-1.5947	0.123867
R4	0.0000	0.00000	24		
T1	0.3333	1.02402	24	0.3255	0.747612
T2	1.5833	1.02402	24	1.5462	0.135143
T3	0.0833	1.02402	24	0.0814	0.935816
T4	0.0000	0.00000	24		
R1:T1	-0.6667	1.18243	24	-0.5638	0.578115
R1:T2	0.3333	1.18243	24	0.2819	0.780433
R1:T3	1.6667	1.18243	24	1.4095	0.171508
R1:T4	0.0000	0.00000	24		
R2:T1	0.3333	1.18243	24	0.2819	0.780433
R2:T2	0.0000	1.18243	24	0.0000	1.000000
R2:T3	-0.6667	1.18243	24	-0.5638	0.578115
R2:T4	0.0000	0.00000	24		
R3:T1	1.0000	1.18243	24	0.8457	0.406066
R3:T2	0.3333	1.18243	24	0.2819	0.780433
R3:T3	0.6667	1.18243	24	0.5638	0.578115
R3:T4	0.0000	0.00000	24		
R4:T1	0.0000	0.00000	24		
R4:T2	0.0000	0.00000	24		
R4:T3	0.0000	0.00000	24		
R4:T4	0.0000	0.00000	24		
G1	-3.4167	1.25416	24	-2.7243	0.011829 *
G2	-2.4167	1.25416	24	-1.9269	0.065909 .
G3	-1.4167	1.25416	24	-1.1296	0.269819
G4	-4.4167	1.25416	24	-3.5216	0.001746 **

G5	-2.4167	1.25416	24	-1.9269	0.065909	.
G6	-1.7500	1.25416	24	-1.3954	0.175687	
G7	-2.7500	1.25416	24	-2.1927	0.038261	*
G8	-1.7500	1.25416	24	-1.3954	0.175687	
G9	0.2500	1.25416	24	0.1993	0.843679	
G10	0.2500	1.25416	24	0.1993	0.843679	
G11	0.2500	1.25416	24	0.1993	0.843679	
G12	0.2500	1.25416	24	0.1993	0.843679	
G13	-1.7500	1.25416	24	-1.3954	0.175687	
G14	-3.7500	1.25416	24	-2.9900	0.006354	**
G15	1.2500	1.25416	24	0.9967	0.328862	
G16	-1.0833	1.25416	24	-0.8638	0.396253	
G17	-1.0833	1.25416	24	-0.8638	0.396253	
G18	-0.0833	1.25416	24	-0.0664	0.947574	
G19	0.9167	1.25416	24	0.7309	0.471916	
G20	-1.0000	0.72409	24	-1.3810	0.179990	
G21	-2.2500	0.72409	24	-3.1074	0.004802	**
G22	0.0000	0.00000	24			
T1:G1	5.3333	1.77365	24	3.0070	0.006104	**
T1:G2	3.3333	1.77365	24	1.8794	0.072391	.
T1:G3	1.3333	1.77365	24	0.7517	0.459513	
T1:G4	3.3333	1.77365	24	1.8794	0.072391	.
T1:G5	5.3333	1.77365	24	3.0070	0.006104	**
T1:G6	-2.6667	1.77365	24	-1.5035	0.145759	
T1:G7	-1.6667	1.77365	24	-0.9397	0.356743	
T1:G8	-1.6667	1.77365	24	-0.9397	0.356743	
T1:G9	-3.6667	1.77365	24	-2.0673	0.049653	*
T1:G10	1.3333	1.77365	24	0.7517	0.459513	
T1:G11	1.6667	1.77365	24	0.9397	0.356743	
T1:G12	1.6667	1.77365	24	0.9397	0.356743	
T1:G13	-4.3333	1.77365	24	-2.4432	0.022292	*
T1:G14	-1.3333	1.77365	24	-0.7517	0.459513	
T1:G15	0.6667	1.77365	24	0.3759	0.710313	
T1:G16	2.6667	1.77365	24	1.5035	0.145759	
T1:G17	2.6667	1.77365	24	1.5035	0.145759	
T1:G18	1.6667	1.77365	24	0.9397	0.356743	
T1:G19	0.6667	1.77365	24	0.3759	0.710313	
T1:G20	1.0000	1.02402	24	0.9765	0.338535	
T1:G21	1.0000	1.02402	24	0.9765	0.338535	
T1:G22	0.0000	0.00000	24			
T2:G1	4.0833	1.77365	24	2.3022	0.030304	*
T2:G2	2.0833	1.77365	24	1.1746	0.251677	
T2:G3	-1.9167	1.77365	24	-1.0806	0.290600	
T2:G4	1.0833	1.77365	24	0.6108	0.547078	
T2:G5	2.0833	1.77365	24	1.1746	0.251677	
T2:G6	-3.5833	1.77365	24	-2.0203	0.054646	.
T2:G7	-3.5833	1.77365	24	-2.0203	0.054646	.
T2:G8	-4.5833	1.77365	24	-2.5841	0.016278	*

T2:G9	-3.5833	1.77365	24	-2.0203	0.054646	.
T2:G10	-1.5833	1.77365	24	-0.8927	0.380883	
T2:G11	1.0833	1.77365	24	0.6108	0.547078	
T2:G12	-0.9167	1.77365	24	-0.5168	0.610008	
T2:G13	-3.9167	1.77365	24	-2.2083	0.037026	*
T2:G14	-2.9167	1.77365	24	-1.6444	0.113121	
T2:G15	0.0833	1.77365	24	0.0470	0.962915	
T2:G16	0.4167	1.77365	24	0.2349	0.816263	
T2:G17	1.4167	1.77365	24	0.7987	0.432281	
T2:G18	-1.5833	1.77365	24	-0.8927	0.380883	
T2:G19	-3.5833	1.77365	24	-2.0203	0.054646	.
T2:G20	1.2500	1.02402	24	1.2207	0.234064	
T2:G21	-1.0000	1.02402	24	-0.9765	0.338535	
T2:G22	0.0000	0.00000	24			
T3:G1	0.2500	1.77365	24	0.1410	0.889084	
T3:G2	0.2500	1.77365	24	0.1410	0.889084	
T3:G3	0.2500	1.77365	24	0.1410	0.889084	
T3:G4	0.2500	1.77365	24	0.1410	0.889084	
T3:G5	0.2500	1.77365	24	0.1410	0.889084	
T3:G6	-1.4167	1.77365	24	-0.7987	0.432281	
T3:G7	-0.4167	1.77365	24	-0.2349	0.816263	
T3:G8	-1.4167	1.77365	24	-0.7987	0.432281	
T3:G9	-0.4167	1.77365	24	-0.2349	0.816263	
T3:G10	0.5833	1.77365	24	0.3289	0.745093	
T3:G11	0.2500	1.77365	24	0.1410	0.889084	
T3:G12	0.2500	1.77365	24	0.1410	0.889084	
T3:G13	-1.7500	1.77365	24	-0.9867	0.333650	
T3:G14	-0.7500	1.77365	24	-0.4229	0.676165	
T3:G15	0.2500	1.77365	24	0.1410	0.889084	
T3:G16	0.9167	1.77365	24	0.5168	0.610008	
T3:G17	0.9167	1.77365	24	0.5168	0.610008	
T3:G18	1.9167	1.77365	24	1.0806	0.290600	
T3:G19	0.9167	1.77365	24	0.5168	0.610008	
T3:G20	0.5000	1.02402	24	0.4883	0.629788	
T3:G21	0.2500	1.02402	24	0.2441	0.809200	
T3:G22	0.0000	0.00000	24			
T4:G1	0.0000	0.00000	24			
T4:G2	0.0000	0.00000	24			
T4:G3	0.0000	0.00000	24			
T4:G4	0.0000	0.00000	24			
T4:G5	0.0000	0.00000	24			
T4:G6	0.0000	0.00000	24			
T4:G7	0.0000	0.00000	24			
T4:G8	0.0000	0.00000	24			
T4:G9	0.0000	0.00000	24			
T4:G10	0.0000	0.00000	24			
T4:G11	0.0000	0.00000	24			
T4:G12	0.0000	0.00000	24			

T4:G13	0.0000	0.00000	24
T4:G14	0.0000	0.00000	24
T4:G15	0.0000	0.00000	24
T4:G16	0.0000	0.00000	24
T4:G17	0.0000	0.00000	24
T4:G18	0.0000	0.00000	24
T4:G19	0.0000	0.00000	24
T4:G20	0.0000	0.00000	24
T4:G21	0.0000	0.00000	24
T4:G22	0.0000	0.00000	24

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

7.10 Example 7.3

(86) MODEL

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

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	155	656.12	4.2330	13.446	3.997e-14 ***
RESIDUALS	36	11.33	0.3148		
CORRECTED TOTAL	191	667.45			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	27.06	9.019	28.6489	1.203e-09 ***
T	1	10.55	10.547	33.5018	1.334e-06 ***
R:T	3	2.97	0.991	3.1489	0.036705 *
G	22	389.01	17.682	56.1668	< 2.2e-16 ***
T:G	22	18.42	0.837	2.6601	0.004445 **
R:T:G	12	8.78	0.731	2.3235	0.025315 *
F	2	164.28	82.141	260.9173	< 2.2e-16 ***
T:F	2	0.84	0.422	1.3401	0.274574
G:F	44	23.47	0.533	1.6943	0.053191 .
T:G:F	44	10.74	0.244	0.7753	0.790640

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	12.49	4.162	13.2206	5.655e-06 ***
T	1	10.55	10.547	33.5018	1.334e-06 ***
R:T	3	1.15	0.384	1.2206	0.316281
G	22	389.01	17.682	56.1668	< 2.2e-16 ***
T:G	22	18.42	0.837	2.6601	0.004445 **
R:T:G	12	8.78	0.731	2.3235	0.025315 *
F	2	164.28	82.141	260.9173	< 2.2e-16 ***
T:F	2	0.84	0.422	1.3401	0.274574
G:F	44	23.47	0.533	1.6943	0.053191 .
T:G:F	44	10.74	0.244	0.7753	0.790640

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	12.49	4.162	13.2206	5.655e-06 ***
T	1	11.16	11.158	35.4430	8.021e-07 ***
R:T	3	1.15	0.384	1.2206	0.316281
G	22	389.01	17.682	56.1668	< 2.2e-16 ***
T:G	22	18.42	0.837	2.6601	0.004445 **
R:T:G	12	8.78	0.731	2.3235	0.025315 *
F	2	120.56	60.282	191.4828	< 2.2e-16 ***
T:F	2	0.82	0.411	1.3060	0.283432
G:F	44	23.47	0.533	1.6943	0.053191 .
T:G:F	44	10.74	0.244	0.7753	0.790640

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	9.0000	0.39675	36	22.6845	< 2.2e-16 ***
R1	-1.0000	0.45812	36	-2.1828	0.0356525 *
R2	-1.0000	0.45812	36	-2.1828	0.0356525 *
R3	0.0000	0.45812	36	0.0000	1.0000000
R4	0.0000	0.00000	36		
T1	-0.2500	0.56108	36	-0.4456	0.6585786
T2	0.0000	0.00000	36		
R1:T1	0.3333	0.64788	36	0.5145	0.6100498
R1:T2	0.0000	0.00000	36		
R2:T1	0.6667	0.64788	36	1.0290	0.3103479
R2:T2	0.0000	0.00000	36		
R3:T1	0.0000	0.64788	36	0.0000	1.0000000
R3:T2	0.0000	0.00000	36		
R4:T1	0.0000	0.00000	36		
R4:T2	0.0000	0.00000	36		
G1	-3.0000	0.68718	36	-4.3656	0.0001024 ***
G2	0.0000	0.68718	36	0.0000	1.0000000

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

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

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

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

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

R4:T2:G13						
R4:T2:G14						
R4:T2:G15						
R4:T2:G16	0.0000	0.00000	36			
R4:T2:G17	0.0000	0.00000	36			
R4:T2:G18	0.0000	0.00000	36			
R4:T2:G19	0.0000	0.00000	36			
R4:T2:G20	0.0000	0.00000	36			
R4:T2:G21	0.0000	0.00000	36			
R4:T2:G22	0.0000	0.00000	36			
R4:T2:G23	0.0000	0.00000	36			
F1	-2.0000	0.39675	36	-5.0410	1.325e-05	***
F2	-1.0000	0.39675	36	-2.5205	0.0162919	*
F3	0.0000	0.00000	36			
T1:F1	-0.2500	0.56108	36	-0.4456	0.6585786	
T1:F2	0.0000	0.56108	36	0.0000	1.0000000	
T1:F3	0.0000	0.00000	36			
T2:F1	0.0000	0.00000	36			
T2:F2	0.0000	0.00000	36			
T2:F3	0.0000	0.00000	36			
G1:F1	0.0000	0.88715	36	0.0000	1.0000000	
G1:F2	0.0000	0.88715	36	0.0000	1.0000000	
G1:F3	0.0000	0.00000	36			
G2:F1	-2.0000	0.88715	36	-2.2544	0.0303508	*
G2:F2	-1.0000	0.88715	36	-1.1272	0.2671137	
G2:F3	0.0000	0.00000	36			
G3:F1	0.0000	0.88715	36	0.0000	1.0000000	
G3:F2	0.0000	0.88715	36	0.0000	1.0000000	
G3:F3	0.0000	0.00000	36			
G4:F1	2.0000	0.88715	36	2.2544	0.0303508	*
G4:F2	0.0000	0.88715	36	0.0000	1.0000000	
G4:F3	0.0000	0.00000	36			
G5:F1	0.0000	0.88715	36	0.0000	1.0000000	
G5:F2	1.0000	0.88715	36	1.1272	0.2671137	
G5:F3	0.0000	0.00000	36			
G6:F1	0.0000	0.88715	36	0.0000	1.0000000	
G6:F2	0.0000	0.88715	36	0.0000	1.0000000	
G6:F3	0.0000	0.00000	36			
G7:F1	1.0000	0.88715	36	1.1272	0.2671137	
G7:F2	1.0000	0.88715	36	1.1272	0.2671137	
G7:F3	0.0000	0.00000	36			
G8:F1	1.0000	0.88715	36	1.1272	0.2671137	
G8:F2	2.0000	0.88715	36	2.2544	0.0303508	*
G8:F3	0.0000	0.00000	36			
G9:F1	0.0000	0.88715	36	0.0000	1.0000000	
G9:F2	-1.0000	0.88715	36	-1.1272	0.2671137	
G9:F3	0.0000	0.00000	36			
G10:F1	-1.0000	0.88715	36	-1.1272	0.2671137	

G10:F2	-1.0000	0.88715	36	-1.1272	0.2671137
G10:F3	0.0000	0.00000	36		
G11:F1	1.0000	0.88715	36	1.1272	0.2671137
G11:F2	0.0000	0.88715	36	0.0000	1.0000000
G11:F3	0.0000	0.00000	36		
G12:F1	1.0000	0.88715	36	1.1272	0.2671137
G12:F2	0.0000	0.88715	36	0.0000	1.0000000
G12:F3	0.0000	0.00000	36		
G13:F1	0.0000	0.88715	36	0.0000	1.0000000
G13:F2	-1.0000	0.88715	36	-1.1272	0.2671137
G13:F3	0.0000	0.00000	36		
G14:F1	1.0000	0.88715	36	1.1272	0.2671137
G14:F2	1.0000	0.88715	36	1.1272	0.2671137
G14:F3	0.0000	0.00000	36		
G15:F1	-1.0000	0.88715	36	-1.1272	0.2671137
G15:F2	-1.0000	0.88715	36	-1.1272	0.2671137
G15:F3	0.0000	0.00000	36		
G16:F1	0.0000	0.88715	36	0.0000	1.0000000
G16:F2	-1.0000	0.88715	36	-1.1272	0.2671137
G16:F3	0.0000	0.00000	36		
G17:F1	-1.0000	0.88715	36	-1.1272	0.2671137
G17:F2	0.0000	0.88715	36	0.0000	1.0000000
G17:F3	0.0000	0.00000	36		
G18:F1	-1.0000	0.88715	36	-1.1272	0.2671137
G18:F2	0.0000	0.88715	36	0.0000	1.0000000
G18:F3	0.0000	0.00000	36		
G19:F1	0.0000	0.88715	36	0.0000	1.0000000
G19:F2	1.0000	0.88715	36	1.1272	0.2671137
G19:F3	0.0000	0.00000	36		
G20:F1	0.0000	0.88715	36	0.0000	1.0000000
G20:F2	0.0000	0.88715	36	0.0000	1.0000000
G20:F3	0.0000	0.00000	36		
G21:F1	-1.2500	0.56108	36	-2.2278	0.0322306 *
G21:F2	0.2500	0.56108	36	0.4456	0.6585786
G21:F3	0.0000	0.00000	36		
G22:F1	0.0000	0.56108	36	0.0000	1.0000000
G22:F2	0.0000	0.56108	36	0.0000	1.0000000
G22:F3	0.0000	0.00000	36		
G23:F1	0.0000	0.00000	36		
G23:F2	0.0000	0.00000	36		
G23:F3	0.0000	0.00000	36		
T1:G1:F1	-1.7500	1.25462	36	-1.3948	0.1716105
T1:G1:F2	-1.0000	1.25462	36	-0.7971	0.4306457
T1:G1:F3	0.0000	0.00000	36		
T1:G2:F1	0.2500	1.25462	36	0.1993	0.8431780
T1:G2:F2	0.0000	1.25462	36	0.0000	1.0000000
T1:G2:F3	0.0000	0.00000	36		
T1:G3:F1	0.2500	1.25462	36	0.1993	0.8431780

T1:G3:F2	-1.0000	1.25462	36	-0.7971	0.4306457
T1:G3:F3	0.0000	0.00000	36		
T1:G4:F1	-0.7500	1.25462	36	-0.5978	0.5537222
T1:G4:F2	0.0000	1.25462	36	0.0000	1.0000000
T1:G4:F3	0.0000	0.00000	36		
T1:G5:F1	1.2500	1.25462	36	0.9963	0.3257463
T1:G5:F2	-1.0000	1.25462	36	-0.7971	0.4306457
T1:G5:F3	0.0000	0.00000	36		
T1:G6:F1	0.2500	1.25462	36	0.1993	0.8431780
T1:G6:F2	0.0000	1.25462	36	0.0000	1.0000000
T1:G6:F3	0.0000	0.00000	36		
T1:G7:F1	-0.7500	1.25462	36	-0.5978	0.5537222
T1:G7:F2	-1.0000	1.25462	36	-0.7971	0.4306457
T1:G7:F3	0.0000	0.00000	36		
T1:G8:F1	-0.7500	1.25462	36	-0.5978	0.5537222
T1:G8:F2	-2.0000	1.25462	36	-1.5941	0.1196553
T1:G8:F3	0.0000	0.00000	36		
T1:G9:F1	0.2500	1.25462	36	0.1993	0.8431780
T1:G9:F2	1.0000	1.25462	36	0.7971	0.4306457
T1:G9:F3	0.0000	0.00000	36		
T1:G10:F1	0.2500	1.25462	36	0.1993	0.8431780
T1:G10:F2	1.0000	1.25462	36	0.7971	0.4306457
T1:G10:F3	0.0000	0.00000	36		
T1:G11:F1	-0.7500	1.25462	36	-0.5978	0.5537222
T1:G11:F2	0.0000	1.25462	36	0.0000	1.0000000
T1:G11:F3	0.0000	0.00000	36		
T1:G12:F1	0.2500	1.25462	36	0.1993	0.8431780
T1:G12:F2	1.0000	1.25462	36	0.7971	0.4306457
T1:G12:F3	0.0000	0.00000	36		
T1:G13:F1	1.2500	1.25462	36	0.9963	0.3257463
T1:G13:F2	2.0000	1.25462	36	1.5941	0.1196553
T1:G13:F3	0.0000	0.00000	36		
T1:G14:F1	-0.7500	1.25462	36	-0.5978	0.5537222
T1:G14:F2	-2.0000	1.25462	36	-1.5941	0.1196553
T1:G14:F3	0.0000	0.00000	36		
T1:G15:F1	1.2500	1.25462	36	0.9963	0.3257463
T1:G15:F2	1.0000	1.25462	36	0.7971	0.4306457
T1:G15:F3	0.0000	0.00000	36		
T1:G16:F1	-1.7500	1.25462	36	-1.3948	0.1716105
T1:G16:F2	0.0000	1.25462	36	0.0000	1.0000000
T1:G16:F3	0.0000	0.00000	36		
T1:G17:F1	0.2500	1.25462	36	0.1993	0.8431780
T1:G17:F2	0.0000	1.25462	36	0.0000	1.0000000
T1:G17:F3	0.0000	0.00000	36		
T1:G18:F1	0.2500	1.25462	36	0.1993	0.8431780
T1:G18:F2	-1.0000	1.25462	36	-0.7971	0.4306457
T1:G18:F3	0.0000	0.00000	36		
T1:G19:F1	-0.7500	1.25462	36	-0.5978	0.5537222

T1:G19:F2	-2.0000	1.25462	36	-1.5941	0.1196553
T1:G19:F3	0.0000	0.00000	36		
T1:G20:F1	0.2500	1.25462	36	0.1993	0.8431780
T1:G20:F2	-1.0000	1.25462	36	-0.7971	0.4306457
T1:G20:F3	0.0000	0.00000	36		
T1:G21:F1	0.2500	0.79349	36	0.3151	0.7545328
T1:G21:F2	-0.7500	0.79349	36	-0.9452	0.3508634
T1:G21:F3	0.0000	0.00000	36		
T1:G22:F1	0.0000	0.79349	36	0.0000	1.0000000
T1:G22:F2	0.0000	0.79349	36	0.0000	1.0000000
T1:G22:F3	0.0000	0.00000	36		
T1:G23:F1	0.0000	0.00000	36		
T1:G23:F2	0.0000	0.00000	36		
T1:G23:F3	0.0000	0.00000	36		
T2:G1:F1	0.0000	0.00000	36		
T2:G1:F2	0.0000	0.00000	36		
T2:G1:F3	0.0000	0.00000	36		
T2:G2:F1	0.0000	0.00000	36		
T2:G2:F2	0.0000	0.00000	36		
T2:G2:F3	0.0000	0.00000	36		
T2:G3:F1	0.0000	0.00000	36		
T2:G3:F2	0.0000	0.00000	36		
T2:G3:F3	0.0000	0.00000	36		
T2:G4:F1	0.0000	0.00000	36		
T2:G4:F2	0.0000	0.00000	36		
T2:G4:F3	0.0000	0.00000	36		
T2:G5:F1	0.0000	0.00000	36		
T2:G5:F2	0.0000	0.00000	36		
T2:G5:F3	0.0000	0.00000	36		
T2:G6:F1	0.0000	0.00000	36		
T2:G6:F2	0.0000	0.00000	36		
T2:G6:F3	0.0000	0.00000	36		
T2:G7:F1	0.0000	0.00000	36		
T2:G7:F2	0.0000	0.00000	36		
T2:G7:F3	0.0000	0.00000	36		
T2:G8:F1	0.0000	0.00000	36		
T2:G8:F2	0.0000	0.00000	36		
T2:G8:F3	0.0000	0.00000	36		
T2:G9:F1	0.0000	0.00000	36		
T2:G9:F2	0.0000	0.00000	36		
T2:G9:F3	0.0000	0.00000	36		
T2:G10:F1	0.0000	0.00000	36		
T2:G10:F2	0.0000	0.00000	36		
T2:G10:F3	0.0000	0.00000	36		
T2:G11:F1	0.0000	0.00000	36		
T2:G11:F2	0.0000	0.00000	36		
T2:G11:F3	0.0000	0.00000	36		
T2:G12:F1	0.0000	0.00000	36		

T2:G12:F2	0.0000	0.00000	36
T2:G12:F3	0.0000	0.00000	36
T2:G13:F1	0.0000	0.00000	36
T2:G13:F2	0.0000	0.00000	36
T2:G13:F3	0.0000	0.00000	36
T2:G14:F1	0.0000	0.00000	36
T2:G14:F2	0.0000	0.00000	36
T2:G14:F3	0.0000	0.00000	36
T2:G15:F1	0.0000	0.00000	36
T2:G15:F2	0.0000	0.00000	36
T2:G15:F3	0.0000	0.00000	36
T2:G16:F1	0.0000	0.00000	36
T2:G16:F2	0.0000	0.00000	36
T2:G16:F3	0.0000	0.00000	36
T2:G17:F1	0.0000	0.00000	36
T2:G17:F2	0.0000	0.00000	36
T2:G17:F3	0.0000	0.00000	36
T2:G18:F1	0.0000	0.00000	36
T2:G18:F2	0.0000	0.00000	36
T2:G18:F3	0.0000	0.00000	36
T2:G19:F1	0.0000	0.00000	36
T2:G19:F2	0.0000	0.00000	36
T2:G19:F3	0.0000	0.00000	36
T2:G20:F1	0.0000	0.00000	36
T2:G20:F2	0.0000	0.00000	36
T2:G20:F3	0.0000	0.00000	36
T2:G21:F1	0.0000	0.00000	36
T2:G21:F2	0.0000	0.00000	36
T2:G21:F3	0.0000	0.00000	36
T2:G22:F1	0.0000	0.00000	36
T2:G22:F2	0.0000	0.00000	36
T2:G22:F3	0.0000	0.00000	36
T2:G23:F1	0.0000	0.00000	36
T2:G23:F2	0.0000	0.00000	36
T2:G23:F3	0.0000	0.00000	36

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

```
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

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

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	104	3951.8	37.999		
RESIDUALS	0	0.0			
CORRECTED TOTAL	104	3951.8			

\$`Type I`

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

\$`Type II`

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

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

\$`Type III`

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

\$Parameter

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

R2:A2		
R2:A3		
R2:A4	0	0
R2:A5	0	0
R2:A6	0	0
R2:A7		
R2:A8		
R2:A9		
R2:A10	5	0
R2:A11	0	0
R2:A12	0	0
R2:A13	0	0
R3:A1		
R3:A2		
R3:A3		
R3:A4		
R3:A5		
R3:A6		
R3:A7	0	0
R3:A8	0	0
R3:A9	0	0
R3:A10	0	0
R3:A11	0	0
R3:A12	0	0
R3:A13	0	0
B1	5	0
B2	3	0
B3	5	0
B4	3	0
B5	-5	0
B6	3	0
B7	-1	0
B8	1	0
B9	0	0
R1:B1	0	0
R1:B2	0	0
R1:B3		
R1:B4		
R1:B5		
R1:B6		
R1:B7	0	0
R1:B8	0	0
R1:B9	0	0
R2:B1		
R2:B2		
R2:B3	0	0
R2:B4	0	0
R2:B5		

R2:B6		
R2:B7	10	0
R2:B8	0	0
R2:B9	0	0
R3:B1		
R3:B2		
R3:B3		
R3:B4		
R3:B5	0	0
R3:B6	0	0
R3:B7	0	0
R3:B8	0	0
R3:B9	0	0
A1:B1	-1	0
A1:B2	-6	0
A1:B3		
A1:B4		
A1:B5		
A1:B6		
A1:B7	4	0
A1:B8	1	0
A1:B9	0	0
A2:B1	0	0
A2:B2	0	0
A2:B3		
A2:B4		
A2:B5		
A2:B6		
A2:B7	0	0
A2:B8	0	0
A2:B9	0	0
A3:B1	-1	0
A3:B2	-6	0
A3:B3		
A3:B4		
A3:B5		
A3:B6		
A3:B7	4	0
A3:B8	1	0
A3:B9	0	0
A4:B1		
A4:B2		
A4:B3	-4	0
A4:B4	-4	0
A4:B5		
A4:B6		
A4:B7	-4	0
A4:B8	-1	0

A4:B9	0	0
A5:B1		
A5:B2		
A5:B3	-4	0
A5:B4	1	0
A5:B5		
A5:B6		
A5:B7	-9	0
A5:B8	-2	0
A5:B9	0	0
A6:B1		
A6:B2		
A6:B3	-8	0
A6:B4	-8	0
A6:B5		
A6:B6		
A6:B7	-8	0
A6:B8	-4	0
A6:B9	0	0
A7:B1		
A7:B2		
A7:B3		
A7:B4		
A7:B5	10	0
A7:B6	0	0
A7:B7	0	0
A7:B8	0	0
A7:B9	0	0
A8:B1		
A8:B2		
A8:B3		
A8:B4		
A8:B5	-21	0
A8:B6	-36	0
A8:B7	-26	0
A8:B8	-29	0
A8:B9	0	0
A9:B1		
A9:B2		
A9:B3		
A9:B4		
A9:B5	-10	0
A9:B6	-20	0
A9:B7	-20	0
A9:B8	-10	0
A9:B9	0	0
A10:B1	-1	0
A10:B2	-7	0

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

R1:A2:B6		
R1:A2:B7	0	0
R1:A2:B8	0	0
R1:A2:B9	0	0
R1:A3:B1	0	0
R1:A3:B2	0	0
R1:A3:B3		
R1:A3:B4		
R1:A3:B5		
R1:A3:B6		
R1:A3:B7	0	0
R1:A3:B8	0	0
R1:A3:B9	0	0
R1:A4:B1		
R1:A4:B2		
R1:A4:B3		
R1:A4:B4		
R1:A4:B5		
R1:A4:B6		
R1:A4:B7		
R1:A4:B8		
R1:A4:B9		
R1:A5:B1		
R1:A5:B2		
R1:A5:B3		
R1:A5:B4		
R1:A5:B5		
R1:A5:B6		
R1:A5:B7		
R1:A5:B8		
R1:A5:B9		
R1:A6:B1		
R1:A6:B2		
R1:A6:B3		
R1:A6:B4		
R1:A6:B5		
R1:A6:B6		
R1:A6:B7		
R1:A6:B8		
R1:A6:B9		
R1:A7:B1		
R1:A7:B2		
R1:A7:B3		
R1:A7:B4		
R1:A7:B5		
R1:A7:B6		
R1:A7:B7		
R1:A7:B8		

R1:A7:B9		
R1:A8:B1		
R1:A8:B2		
R1:A8:B3		
R1:A8:B4		
R1:A8:B5		
R1:A8:B6		
R1:A8:B7		
R1:A8:B8		
R1:A8:B9		
R1:A9:B1		
R1:A9:B2		
R1:A9:B3		
R1:A9:B4		
R1:A9:B5		
R1:A9:B6		
R1:A9:B7		
R1:A9:B8		
R1:A9:B9		
R1:A10:B1	0	0
R1:A10:B2	0	0
R1:A10:B3		
R1:A10:B4		
R1:A10:B5		
R1:A10:B6		
R1:A10:B7	3	0
R1:A10:B8	2	0
R1:A10:B9	0	0
R1:A11:B1	0	0
R1:A11:B2	0	0
R1:A11:B3		
R1:A11:B4		
R1:A11:B5		
R1:A11:B6		
R1:A11:B7	0	0
R1:A11:B8	0	0
R1:A11:B9	0	0
R1:A12:B1	0	0
R1:A12:B2	0	0
R1:A12:B3		
R1:A12:B4		
R1:A12:B5		
R1:A12:B6		
R1:A12:B7	10	0
R1:A12:B8	0	0
R1:A12:B9	0	0
R1:A13:B1	0	0
R1:A13:B2	0	0

R1:A13:B3		
R1:A13:B4		
R1:A13:B5		
R1:A13:B6		
R1:A13:B7	0	0
R1:A13:B8	0	0
R1:A13:B9	0	0
R2:A1:B1		
R2:A1:B2		
R2:A1:B3		
R2:A1:B4		
R2:A1:B5		
R2:A1:B6		
R2:A1:B7		
R2:A1:B8		
R2:A1:B9		
R2:A2:B1		
R2:A2:B2		
R2:A2:B3		
R2:A2:B4		
R2:A2:B5		
R2:A2:B6		
R2:A2:B7		
R2:A2:B8		
R2:A2:B9		
R2:A3:B1		
R2:A3:B2		
R2:A3:B3		
R2:A3:B4		
R2:A3:B5		
R2:A3:B6		
R2:A3:B7		
R2:A3:B8		
R2:A3:B9		
R2:A4:B1		
R2:A4:B2		
R2:A4:B3	0	0
R2:A4:B4	0	0
R2:A4:B5		
R2:A4:B6		
R2:A4:B7	0	0
R2:A4:B8	0	0
R2:A4:B9	0	0
R2:A5:B1		
R2:A5:B2		
R2:A5:B3	0	0
R2:A5:B4	0	0
R2:A5:B5		

R2:A5:B6		
R2:A5:B7	0	0
R2:A5:B8	0	0
R2:A5:B9	0	0
R2:A6:B1		
R2:A6:B2		
R2:A6:B3	0	0
R2:A6:B4	0	0
R2:A6:B5		
R2:A6:B6		
R2:A6:B7	0	0
R2:A6:B8	0	0
R2:A6:B9	0	0
R2:A7:B1		
R2:A7:B2		
R2:A7:B3		
R2:A7:B4		
R2:A7:B5		
R2:A7:B6		
R2:A7:B7		
R2:A7:B8		
R2:A7:B9		
R2:A8:B1		
R2:A8:B2		
R2:A8:B3		
R2:A8:B4		
R2:A8:B5		
R2:A8:B6		
R2:A8:B7		
R2:A8:B8		
R2:A8:B9		
R2:A9:B1		
R2:A9:B2		
R2:A9:B3		
R2:A9:B4		
R2:A9:B5		
R2:A9:B6		
R2:A9:B7		
R2:A9:B8		
R2:A9:B9		
R2:A10:B1		
R2:A10:B2		
R2:A10:B3	0	0
R2:A10:B4	0	0
R2:A10:B5		
R2:A10:B6		
R2:A10:B7	-7	0
R2:A10:B8	2	0

R2:A10:B9	0	0
R2:A11:B1		
R2:A11:B2		
R2:A11:B3	0	0
R2:A11:B4	0	0
R2:A11:B5		
R2:A11:B6		
R2:A11:B7	0	0
R2:A11:B8	0	0
R2:A11:B9	0	0
R2:A12:B1		
R2:A12:B2		
R2:A12:B3	0	0
R2:A12:B4	0	0
R2:A12:B5		
R2:A12:B6		
R2:A12:B7	0	0
R2:A12:B8	0	0
R2:A12:B9	0	0
R2:A13:B1		
R2:A13:B2		
R2:A13:B3	0	0
R2:A13:B4	0	0
R2:A13:B5		
R2:A13:B6		
R2:A13:B7	0	0
R2:A13:B8	0	0
R2:A13:B9	0	0
R3:A1:B1		
R3:A1:B2		
R3:A1:B3		
R3:A1:B4		
R3:A1:B5		
R3:A1:B6		
R3:A1:B7		
R3:A1:B8		
R3:A1:B9		
R3:A2:B1		
R3:A2:B2		
R3:A2:B3		
R3:A2:B4		
R3:A2:B5		
R3:A2:B6		
R3:A2:B7		
R3:A2:B8		
R3:A2:B9		
R3:A3:B1		
R3:A3:B2		

R3:A3:B3		
R3:A3:B4		
R3:A3:B5		
R3:A3:B6		
R3:A3:B7		
R3:A3:B8		
R3:A3:B9		
R3:A4:B1		
R3:A4:B2		
R3:A4:B3		
R3:A4:B4		
R3:A4:B5		
R3:A4:B6		
R3:A4:B7		
R3:A4:B8		
R3:A4:B9		
R3:A5:B1		
R3:A5:B2		
R3:A5:B3		
R3:A5:B4		
R3:A5:B5		
R3:A5:B6		
R3:A5:B7		
R3:A5:B8		
R3:A5:B9		
R3:A6:B1		
R3:A6:B2		
R3:A6:B3		
R3:A6:B4		
R3:A6:B5		
R3:A6:B6		
R3:A6:B7		
R3:A6:B8		
R3:A6:B9		
R3:A7:B1		
R3:A7:B2		
R3:A7:B3		
R3:A7:B4		
R3:A7:B5	0	0
R3:A7:B6	0	0
R3:A7:B7	0	0
R3:A7:B8	0	0
R3:A7:B9	0	0
R3:A8:B1		
R3:A8:B2		
R3:A8:B3		
R3:A8:B4		
R3:A8:B5	0	0

R3:A8:B6	0	0
R3:A8:B7	0	0
R3:A8:B8	0	0
R3:A8:B9	0	0
R3:A9:B1		
R3:A9:B2		
R3:A9:B3		
R3:A9:B4		
R3:A9:B5	0	0
R3:A9:B6	0	0
R3:A9:B7	0	0
R3:A9:B8	0	0
R3:A9:B9	0	0
R3:A10:B1		
R3:A10:B2		
R3:A10:B3		
R3:A10:B4		
R3:A10:B5	0	0
R3:A10:B6	0	0
R3:A10:B7	0	0
R3:A10:B8	0	0
R3:A10:B9	0	0
R3:A11:B1		
R3:A11:B2		
R3:A11:B3		
R3:A11:B4		
R3:A11:B5	0	0
R3:A11:B6	0	0
R3:A11:B7	0	0
R3:A11:B8	0	0
R3:A11:B9	0	0
R3:A12:B1		
R3:A12:B2		
R3:A12:B3		
R3:A12:B4		
R3:A12:B5	0	0
R3:A12:B6	0	0
R3:A12:B7	0	0
R3:A12:B8	0	0
R3:A12:B9	0	0
R3:A13:B1		
R3:A13:B2		
R3:A13:B3		
R3:A13:B4		
R3:A13:B5	0	0
R3:A13:B6	0	0
R3:A13:B7	0	0
R3:A13:B8	0	0

R3:A13:B9 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	Std. Error	Df	t value	Pr(> t)
(Intercept)	70.167	4.1476	34	16.9175	< 2.2e-16 ***
R1	4.417	3.7862	34	1.1665	0.25152
R2	7.692	3.7862	34	2.0315	0.05008 .
R3	3.492	3.7862	34	0.9222	0.36292
R4	0.000	0.0000	34		
A1	3.390	4.9728	34	0.6816	0.50009
A2	-7.679	4.9728	34	-1.5442	0.13179
A3	-1.235	4.9728	34	-0.2484	0.80529
A4	0.000	0.0000	34		
R1:A1	-1.717	4.7892	34	-0.3584	0.72223
R1:A2	-1.042	4.7892	34	-0.2175	0.82912
R1:A3	-1.467	4.7892	34	-0.3062	0.76129
R1:A4	0.000	0.0000	34		
R2:A1	-8.992	4.7892	34	-1.8775	0.06905 .
R2:A2	-2.817	4.7892	34	-0.5881	0.56033
R2:A3	-4.142	4.7892	34	-0.8648	0.39322
R2:A4	0.000	0.0000	34		
R3:A1	-5.217	4.7892	34	-1.0893	0.28370
R3:A2	-3.292	4.7892	34	-0.6873	0.49655
R3:A3	-4.317	4.7892	34	-0.9013	0.37375
R3:A4	0.000	0.0000	34		
R4:A1	0.000	0.0000	34		
R4:A2	0.000	0.0000	34		
R4:A3	0.000	0.0000	34		
R4:A4	0.000	0.0000	34		
B1	-3.517	3.2790	34	-1.0725	0.29105
B2	-18.817	3.2790	34	-5.7386	1.882e-06 ***
B3	-2.100	3.3865	34	-0.6201	0.53932
B4	0.000	0.0000	34		
A1:B1	5.417	4.3992	34	1.2313	0.22666
A1:B2	-2.558	4.3992	34	-0.5815	0.56471
A1:B3	0.850	4.4799	34	0.1897	0.85064
A1:B4	0.000	0.0000	34		
A2:B1	11.217	4.3992	34	2.5497	0.01546 *
A2:B2	5.567	4.3992	34	1.2654	0.21434
A2:B3	5.500	4.4799	34	1.2277	0.22799
A2:B4	0.000	0.0000	34		
A3:B1	0.492	4.3992	34	0.1118	0.91167
A3:B2	-1.083	4.3992	34	-0.2463	0.80696

A3:B3	3.000	4.4799	34	0.6697	0.50760
A3:B4	0.000	0.0000	34		
A4:B1	0.000	0.0000	34		
A4:B2	0.000	0.0000	34		
A4:B3	0.000	0.0000	34		
A4:B4	0.000	0.0000	34		

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

7.13 Example 9.2

(89) MODEL

```
ex9.2 = read.table("C:/G/Rt/Split/Ex9.2-sbex.txt", header=TRUE)
ex9.2 = af(ex9.2, c("rep", "hyb", "gen"))
GLM(yield ~ rep + hyb + rep:hyb + gen + gen:rep + gen:hyb, ex9.2)
```

\$ANOVA

Response : yield

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	40	247.813	6.1953	4.4606	0.001119 **
RESIDUALS	16	22.222	1.3889		
CORRECTED TOTAL	56	270.035			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	0.239	0.2388	0.1719	0.6839085
hyb	9	66.796	7.4218	5.3437	0.0018370 **
rep:hyb	8	67.000	8.3750	6.0300	0.0011569 **
gen	2	36.351	18.1754	13.0863	0.0004293 ***
rep:gen	2	16.923	8.4616	6.0924	0.0107858 *
hyb:gen	18	60.504	3.3613	2.4201	0.0408545 *

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	0.167	0.1667	0.1200	0.7335481
hyb	9	66.796	7.4218	5.3437	0.0018370 **
rep:hyb	8	67.000	8.3750	6.0300	0.0011569 **
gen	2	36.351	18.1754	13.0863	0.0004293 ***
rep:gen	2	12.111	6.0556	4.3600	0.0308015 *
hyb:gen	18	60.504	3.3613	2.4201	0.0408545 *

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	0.167	0.1667	0.1200	0.7335481
hyb	9	66.796	7.4218	5.3437	0.0018370 **
rep:hyb	8	67.000	8.3750	6.0300	0.0011569 **
gen	2	30.671	15.3356	11.0416	0.0009707 ***
rep:gen	2	12.111	6.0556	4.3600	0.0308015 *
hyb:gen	18	60.504	3.3613	2.4201	0.0408545 *

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	46.556	0.98862	16	47.0915	< 2.2e-16 ***
rep1	0.889	1.06381	16	0.8356	0.415699
rep2	0.000	0.00000	16		
hyb0	-2.444	1.53826	16	-1.5891	0.131602
hyb1	2.667	1.36083	16	1.9596	0.067702 .
hyb2	1.000	1.36083	16	0.7348	0.473067
hyb3	-2.167	1.36083	16	-1.5922	0.130908
hyb4	1.000	1.36083	16	0.7348	0.473067
hyb5	-1.333	1.36083	16	-0.9798	0.341771
hyb6	1.500	1.36083	16	1.1023	0.286649
hyb7	4.500	1.36083	16	3.3068	0.004455 **
hyb8	-0.167	1.36083	16	-0.1225	0.904048
hyb9	0.000	0.00000	16		
rep1:hyb0	0.000	0.00000	16		
rep1:hyb1	-3.333	1.36083	16	-2.4495	0.026199 *
rep1:hyb2	-4.000	1.36083	16	-2.9394	0.009621 **
rep1:hyb3	0.333	1.36083	16	0.2449	0.809610
rep1:hyb4	0.000	1.36083	16	0.0000	1.000000
rep1:hyb5	2.667	1.36083	16	1.9596	0.067702 .
rep1:hyb6	-4.000	1.36083	16	-2.9394	0.009621 **
rep1:hyb7	-3.000	1.36083	16	-2.2045	0.042471 *
rep1:hyb8	-2.667	1.36083	16	-1.9596	0.067702 .
rep1:hyb9	0.000	0.00000	16		
rep2:hyb0					
rep2:hyb1	0.000	0.00000	16		
rep2:hyb2	0.000	0.00000	16		
rep2:hyb3	0.000	0.00000	16		
rep2:hyb4	0.000	0.00000	16		
rep2:hyb5	0.000	0.00000	16		
rep2:hyb6	0.000	0.00000	16		
rep2:hyb7	0.000	0.00000	16		
rep2:hyb8	0.000	0.00000	16		
rep2:hyb9	0.000	0.00000	16		

gen1	-3.056	1.24226	16	-2.4597	0.025671	*
gen2	-0.611	1.24226	16	-0.4919	0.629446	
gen3	0.000	0.00000	16			
rep1:gen1	2.111	0.78567	16	2.6870	0.016197	*
rep1:gen2	0.222	0.78567	16	0.2828	0.780924	
rep1:gen3	0.000	0.00000	16			
rep2:gen1	0.000	0.00000	16			
rep2:gen2	0.000	0.00000	16			
rep2:gen3	0.000	0.00000	16			
hyb0:gen1	3.944	2.07870	16	1.8976	0.075951	.
hyb0:gen2	0.389	2.07870	16	0.1871	0.853947	
hyb0:gen3	0.000	0.00000	16			
hyb1:gen1	-3.000	1.66667	16	-1.8000	0.090743	.
hyb1:gen2	-4.000	1.66667	16	-2.4000	0.028919	*
hyb1:gen3	0.000	0.00000	16			
hyb2:gen1	2.500	1.66667	16	1.5000	0.153088	
hyb2:gen2	-2.500	1.66667	16	-1.5000	0.153088	
hyb2:gen3	0.000	0.00000	16			
hyb3:gen1	2.000	1.66667	16	1.2000	0.247607	
hyb3:gen2	-0.500	1.66667	16	-0.3000	0.768040	
hyb3:gen3	0.000	0.00000	16			
hyb4:gen1	-2.000	1.66667	16	-1.2000	0.247607	
hyb4:gen2	-1.000	1.66667	16	-0.6000	0.556909	
hyb4:gen3	0.000	0.00000	16			
hyb5:gen1	1.000	1.66667	16	0.6000	0.556909	
hyb5:gen2	0.000	1.66667	16	0.0000	1.000000	
hyb5:gen3	0.000	0.00000	16			
hyb6:gen1	-1.000	1.66667	16	-0.6000	0.556909	
hyb6:gen2	-0.500	1.66667	16	-0.3000	0.768040	
hyb6:gen3	0.000	0.00000	16			
hyb7:gen1	-0.500	1.66667	16	-0.3000	0.768040	
hyb7:gen2	-2.000	1.66667	16	-1.2000	0.247607	
hyb7:gen3	0.000	0.00000	16			
hyb8:gen1	2.500	1.66667	16	1.5000	0.153088	
hyb8:gen2	-2.000	1.66667	16	-1.2000	0.247607	
hyb8:gen3	0.000	0.00000	16			
hyb9:gen1	0.000	0.00000	16			
hyb9:gen2	0.000	0.00000	16			
hyb9:gen3	0.000	0.00000	16			

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

```
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(yield ~ rep + hyb + rep:hyb + gen + gen:rep + gen:hyb, ex9.2), type=3,
      singular.ok=TRUE) # NOT OK
```

Note: model has aliased coefficients

sums of squares computed by model comparison

Anova Table (Type III tests)

Response: yield

	Sum Sq	Df	F	values	Pr(>F)
rep	0.000	0			
hyb	66.704	8	6.0033	0.0011847	**
gen	30.671	2	11.0416	0.0009707	***
rep:hyb	67.000	8	6.0300	0.0011569	**
rep:gen	12.111	2	4.3600	0.0308015	*
hyb:gen	60.504	18	2.4201	0.0408545	*
Residuals	22.222	16			

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

7.14 Example 10.1

(90) MODEL

```
ex10.1 = read.table("C:/G/Rt/Split/Ex10.1-new.txt", header=TRUE)
ex10.1 = af(ex10.1, c("Site", "Block", "A", "B", "C"))
f10.1 = Yield ~ Site/Block + A/Site + B/Site + A:B + A:B:Site + A:B:Site:Block +
      C + A:C + B:C + A:B:C + C:Site + A:C:Site + B:C:Site + A:B:C:Site
GLM(f10.1, ex10.1)
```

\$ANOVA

Response : Yield

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	239	1639561484	6860090	2162	< 2.2e-16 ***
RESIDUALS	240	761522	3173		
CORRECTED TOTAL	479	1640323006			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Site	3	552717	184239	5.8064e+01	< 2e-16 ***
Site:Block	8	7062320	882790	2.7822e+02	< 2e-16 ***
A	4	1387680917	346920229	1.0933e+05	< 2e-16 ***
Site:A	12	34068	2839	8.9470e-01	0.55301
B	1	100939695	100939695	3.1812e+04	< 2e-16 ***
Site:B	3	1618	539	1.6990e-01	0.91662
A:B	4	31444008	7861002	2.4775e+03	< 2e-16 ***
Site:A:B	12	33737	2811	8.8600e-01	0.56185
Site:Block:A:B	72	186911	2596	8.1810e-01	0.84155

C	3	19356264	6452088	2.0334e+03	< 2e-16	***
A:C	12	26075792	2172983	6.8483e+02	< 2e-16	***
B:C	3	23901388	7967129	2.5109e+03	< 2e-16	***
A:B:C	12	41996729	3499727	1.1030e+03	< 2e-16	***
Site:C	9	47625	5292	1.6677e+00	0.09747	.
Site:A:C	36	104110	2892	9.1140e-01	0.61768	
Site:B:C	9	61111	6790	2.1400e+00	0.02701	*
Site:A:B:C	36	82475	2291	7.2200e-01	0.87941	

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
Site	3	552717	184239	5.8064e+01	< 2e-16	***
Site:Block	8	7062320	882790	2.7822e+02	< 2e-16	***
A	4	1387680917	346920229	1.0933e+05	< 2e-16	***
Site:A	12	34068	2839	8.9470e-01	0.55301	
B	1	100939695	100939695	3.1812e+04	< 2e-16	***
Site:B	3	1618	539	1.6990e-01	0.91662	
A:B	4	31444008	7861002	2.4775e+03	< 2e-16	***
Site:A:B	12	33737	2811	8.8600e-01	0.56185	
Site:Block:A:B	72	186911	2596	8.1810e-01	0.84155	
C	3	19356264	6452088	2.0334e+03	< 2e-16	***
A:C	12	26075792	2172983	6.8483e+02	< 2e-16	***
B:C	3	23901388	7967129	2.5109e+03	< 2e-16	***
A:B:C	12	41996729	3499727	1.1030e+03	< 2e-16	***
Site:C	9	47625	5292	1.6677e+00	0.09747	.
Site:A:C	36	104110	2892	9.1140e-01	0.61768	
Site:B:C	9	61111	6790	2.1400e+00	0.02701	*
Site:A:B:C	36	82475	2291	7.2200e-01	0.87941	

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
Site	3	552717	184239	5.8064e+01	< 2e-16	***
Site:Block	8	7062320	882790	2.7822e+02	< 2e-16	***
A	4	1387680917	346920229	1.0933e+05	< 2e-16	***
Site:A	12	34068	2839	8.9470e-01	0.55301	
B	1	100939695	100939695	3.1812e+04	< 2e-16	***
Site:B	3	1618	539	1.6990e-01	0.91662	
A:B	4	31444008	7861002	2.4775e+03	< 2e-16	***
Site:A:B	12	33737	2811	8.8600e-01	0.56185	
Site:Block:A:B	72	186911	2596	8.1810e-01	0.84155	
C	3	19356264	6452088	2.0334e+03	< 2e-16	***
A:C	12	26075792	2172983	6.8483e+02	< 2e-16	***
B:C	3	23901388	7967129	2.5109e+03	< 2e-16	***
A:B:C	12	41996729	3499727	1.1030e+03	< 2e-16	***

Site:C	9	47625	5292	1.6677e+00	0.09747	.
Site:A:C	36	104110	2892	9.1140e-01	0.61768	
Site:B:C	9	61111	6790	2.1400e+00	0.02701	*
Site:A:B:C	36	82475	2291	7.2200e-01	0.87941	

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	13608.3	39.831	240	341.6522	< 2.2e-16 ***
Site1	-433.3	56.329	240	-7.6928	3.713e-13 ***
Site2	-108.3	56.329	240	-1.9232	0.055637 .
Site3	-116.7	56.329	240	-2.0711	0.039414 *
Site4	0.0	0.000	240		
Site1:BlockR1	175.0	39.831	240	4.3936	1.674e-05 ***
Site1:BlockR2	300.0	39.831	240	7.5318	1.013e-12 ***
Site1:BlockR3	0.0	0.000	240		
Site2:BlockR1	-225.0	39.831	240	-5.6489	4.554e-08 ***
Site2:BlockR2	-375.0	39.831	240	-9.4148	< 2.2e-16 ***
Site2:BlockR3	0.0	0.000	240		
Site3:BlockR1	-100.0	39.831	240	-2.5106	0.012711 *
Site3:BlockR2	-75.0	39.831	240	-1.8830	0.060916 .
Site3:BlockR3	0.0	0.000	240		
Site4:BlockR1	-250.0	39.831	240	-6.2765	1.605e-09 ***
Site4:BlockR2	-275.0	39.831	240	-6.9042	4.483e-11 ***
Site4:BlockR3	0.0	0.000	240		
AA1	-5705.0	56.329	240	-101.2791	< 2.2e-16 ***
AA2	-5020.2	56.329	240	-89.1230	< 2.2e-16 ***
AA3	-3336.7	56.329	240	-59.2363	< 2.2e-16 ***
AA4	-1241.7	56.329	240	-22.0429	< 2.2e-16 ***
AA5	0.0	0.000	240		
Site1:AA1	-2.4	79.662	240	-0.0303	0.975824
Site1:AA2	25.0	79.662	240	0.3138	0.753926
Site1:AA3	111.2	79.662	240	1.3965	0.163846
Site1:AA4	-16.7	79.662	240	-0.2092	0.834456
Site1:AA5	0.0	0.000	240		
Site2:AA1	91.2	79.662	240	1.1444	0.253590
Site2:AA2	132.4	79.662	240	1.6622	0.097771 .
Site2:AA3	30.7	79.662	240	0.3850	0.700608
Site2:AA4	-50.0	79.662	240	-0.6277	0.530828
Site2:AA5	0.0	0.000	240		
Site3:AA1	39.2	79.662	240	0.4917	0.623408
Site3:AA2	25.8	79.662	240	0.3243	0.746003
Site3:AA3	-38.3	79.662	240	-0.4802	0.631555
Site3:AA4	-41.7	79.662	240	-0.5230	0.601426
Site3:AA5	0.0	0.000	240		
Site4:AA1	0.0	0.000	240		
Site4:AA2	0.0	0.000	240		

Site4:AA3	0.0	0.000	240		
Site4:AA4	0.0	0.000	240		
Site4:AA5	0.0	0.000	240		
BB1	-1300.0	56.329	240	-23.0785	< 2.2e-16 ***
BB2	0.0	0.000	240		
Site1:BB1	-16.7	79.662	240	-0.2092	0.834456
Site1:BB2	0.0	0.000	240		
Site2:BB1	100.0	79.662	240	1.2553	0.210589
Site2:BB2	0.0	0.000	240		
Site3:BB1	0.0	79.662	240	0.0000	1.000000
Site3:BB2	0.0	0.000	240		
Site4:BB1	0.0	0.000	240		
Site4:BB2	0.0	0.000	240		
AA1:BB1	1438.0	79.662	240	18.0513	< 2.2e-16 ***
AA1:BB2	0.0	0.000	240		
AA2:BB1	1746.3	79.662	240	21.9218	< 2.2e-16 ***
AA2:BB2	0.0	0.000	240		
AA3:BB1	2470.3	79.662	240	31.0102	< 2.2e-16 ***
AA3:BB2	0.0	0.000	240		
AA4:BB1	-68.1	79.662	240	-0.8547	0.393595
AA4:BB2	0.0	0.000	240		
AA5:BB1	0.0	0.000	240		
AA5:BB2	0.0	0.000	240		
Site1:AA1:BB1	54.5	112.659	240	0.4838	0.628997
Site1:AA1:BB2	0.0	0.000	240		
Site1:AA2:BB1	-20.4	112.659	240	-0.1812	0.856344
Site1:AA2:BB2	0.0	0.000	240		
Site1:AA3:BB1	-141.2	112.659	240	-1.2530	0.211409
Site1:AA3:BB2	0.0	0.000	240		
Site1:AA4:BB1	45.6	112.659	240	0.4046	0.686122
Site1:AA4:BB2	0.0	0.000	240		
Site1:AA5:BB1	0.0	0.000	240		
Site1:AA5:BB2	0.0	0.000	240		
Site2:AA1:BB1	-90.0	112.659	240	-0.7989	0.425155
Site2:AA1:BB2	0.0	0.000	240		
Site2:AA2:BB1	-140.2	112.659	240	-1.2442	0.214651
Site2:AA2:BB2	0.0	0.000	240		
Site2:AA3:BB1	-60.0	112.659	240	-0.5326	0.594816
Site2:AA3:BB2	0.0	0.000	240		
Site2:AA4:BB1	3.5	112.659	240	0.0311	0.975242
Site2:AA4:BB2	0.0	0.000	240		
Site2:AA5:BB1	0.0	0.000	240		
Site2:AA5:BB2	0.0	0.000	240		
Site3:AA1:BB1	12.4	112.659	240	0.1102	0.912331
Site3:AA1:BB2	0.0	0.000	240		
Site3:AA2:BB1	39.4	112.659	240	0.3499	0.726739
Site3:AA2:BB2	0.0	0.000	240		
Site3:AA3:BB1	49.8	112.659	240	0.4423	0.658643

Site3:AA3:BB2	0.0	0.000	240		
Site3:AA4:BB1	32.7	112.659	240	0.2900	0.772097
Site3:AA4:BB2	0.0	0.000	240		
Site3:AA5:BB1	0.0	0.000	240		
Site3:AA5:BB2	0.0	0.000	240		
Site4:AA1:BB1	0.0	0.000	240		
Site4:AA1:BB2	0.0	0.000	240		
Site4:AA2:BB1	0.0	0.000	240		
Site4:AA2:BB2	0.0	0.000	240		
Site4:AA3:BB1	0.0	0.000	240		
Site4:AA3:BB2	0.0	0.000	240		
Site4:AA4:BB1	0.0	0.000	240		
Site4:AA4:BB2	0.0	0.000	240		
Site4:AA5:BB1	0.0	0.000	240		
Site4:AA5:BB2	0.0	0.000	240		
Site1:BlockR1:AA1:BB1	15.5	56.329	240	0.2752	0.783425
Site1:BlockR1:AA1:BB2	-3.5	56.329	240	-0.0621	0.950507
Site1:BlockR1:AA2:BB1	70.2	56.329	240	1.2471	0.213567
Site1:BlockR1:AA2:BB2	50.0	56.329	240	0.8876	0.375626
Site1:BlockR1:AA3:BB1	10.0	56.329	240	0.1775	0.859244
Site1:BlockR1:AA3:BB2	-62.3	56.329	240	-1.1051	0.270221
Site1:BlockR1:AA4:BB1	50.5	56.329	240	0.8965	0.370878
Site1:BlockR1:AA4:BB2	0.0	56.329	240	0.0000	1.000000
Site1:BlockR1:AA5:BB1	50.0	56.329	240	0.8876	0.375626
Site1:BlockR1:AA5:BB2	0.0	0.000	240		
Site1:BlockR2:AA1:BB1	17.2	56.329	240	0.3062	0.759692
Site1:BlockR2:AA1:BB2	53.7	56.329	240	0.9542	0.340939
Site1:BlockR2:AA2:BB1	61.7	56.329	240	1.0962	0.274077
Site1:BlockR2:AA2:BB2	77.7	56.329	240	1.3803	0.168787
Site1:BlockR2:AA3:BB1	29.0	56.329	240	0.5148	0.607147
Site1:BlockR2:AA3:BB2	-112.3	56.329	240	-1.9927	0.047423 *
Site1:BlockR2:AA4:BB1	42.0	56.329	240	0.7456	0.456631
Site1:BlockR2:AA4:BB2	75.0	56.329	240	1.3315	0.184303
Site1:BlockR2:AA5:BB1	0.0	56.329	240	0.0000	1.000000
Site1:BlockR2:AA5:BB2	0.0	0.000	240		
Site1:BlockR3:AA1:BB1	0.0	0.000	240		
Site1:BlockR3:AA1:BB2	0.0	0.000	240		
Site1:BlockR3:AA2:BB1	0.0	0.000	240		
Site1:BlockR3:AA2:BB2	0.0	0.000	240		
Site1:BlockR3:AA3:BB1	0.0	0.000	240		
Site1:BlockR3:AA3:BB2	0.0	0.000	240		
Site1:BlockR3:AA4:BB1	0.0	0.000	240		
Site1:BlockR3:AA4:BB2	0.0	0.000	240		
Site1:BlockR3:AA5:BB1	0.0	0.000	240		
Site1:BlockR3:AA5:BB2	0.0	0.000	240		
Site2:BlockR1:AA1:BB1	35.7	56.329	240	0.6347	0.526255
Site2:BlockR1:AA1:BB2	-32.3	56.329	240	-0.5725	0.567503
Site2:BlockR1:AA2:BB1	68.5	56.329	240	1.2161	0.225157

Site2:BlockR1:AA2:BB2	-37.5	56.329	240	-0.6657	0.506225
Site2:BlockR1:AA3:BB1	-11.0	56.329	240	-0.1953	0.845339
Site2:BlockR1:AA3:BB2	-30.3	56.329	240	-0.5370	0.591752
Site2:BlockR1:AA4:BB1	46.2	56.329	240	0.8211	0.412426
Site2:BlockR1:AA4:BB2	25.0	56.329	240	0.4438	0.657574
Site2:BlockR1:AA5:BB1	50.0	56.329	240	0.8876	0.375626
Site2:BlockR1:AA5:BB2	0.0	0.000	240		
Site2:BlockR2:AA1:BB1	56.7	56.329	240	1.0075	0.314726
Site2:BlockR2:AA1:BB2	-22.3	56.329	240	-0.3950	0.693196
Site2:BlockR2:AA2:BB1	32.5	56.329	240	0.5770	0.564505
Site2:BlockR2:AA2:BB2	-60.0	56.329	240	-1.0652	0.287873
Site2:BlockR2:AA3:BB1	-1.8	56.329	240	-0.0311	0.975242
Site2:BlockR2:AA3:BB2	-42.5	56.329	240	-0.7545	0.451295
Site2:BlockR2:AA4:BB1	22.5	56.329	240	0.3994	0.689927
Site2:BlockR2:AA4:BB2	50.0	56.329	240	0.8876	0.375626
Site2:BlockR2:AA5:BB1	50.0	56.329	240	0.8876	0.375626
Site2:BlockR2:AA5:BB2	0.0	0.000	240		
Site2:BlockR3:AA1:BB1	0.0	0.000	240		
Site2:BlockR3:AA1:BB2	0.0	0.000	240		
Site2:BlockR3:AA2:BB1	0.0	0.000	240		
Site2:BlockR3:AA2:BB2	0.0	0.000	240		
Site2:BlockR3:AA3:BB1	0.0	0.000	240		
Site2:BlockR3:AA3:BB2	0.0	0.000	240		
Site2:BlockR3:AA4:BB1	0.0	0.000	240		
Site2:BlockR3:AA4:BB2	0.0	0.000	240		
Site2:BlockR3:AA5:BB1	0.0	0.000	240		
Site2:BlockR3:AA5:BB2	0.0	0.000	240		
Site3:BlockR1:AA1:BB1	17.2	56.329	240	0.3062	0.759692
Site3:BlockR1:AA1:BB2	-3.8	56.329	240	-0.0666	0.946977
Site3:BlockR1:AA2:BB1	4.2	56.329	240	0.0754	0.939920
Site3:BlockR1:AA2:BB2	-1.5	56.329	240	-0.0266	0.978778
Site3:BlockR1:AA3:BB1	-13.0	56.329	240	-0.2308	0.817678
Site3:BlockR1:AA3:BB2	50.0	56.329	240	0.8876	0.375626
Site3:BlockR1:AA4:BB1	-18.0	56.329	240	-0.3195	0.749589
Site3:BlockR1:AA4:BB2	25.0	56.329	240	0.4438	0.657574
Site3:BlockR1:AA5:BB1	0.0	56.329	240	0.0000	1.000000
Site3:BlockR1:AA5:BB2	0.0	0.000	240		
Site3:BlockR2:AA1:BB1	21.0	56.329	240	0.3728	0.709621
Site3:BlockR2:AA1:BB2	15.2	56.329	240	0.2707	0.786832
Site3:BlockR2:AA2:BB1	-5.3	56.329	240	-0.0932	0.925821
Site3:BlockR2:AA2:BB2	15.7	56.329	240	0.2796	0.780021
Site3:BlockR2:AA3:BB1	-22.5	56.329	240	-0.3994	0.689927
Site3:BlockR2:AA3:BB2	75.0	56.329	240	1.3315	0.184303
Site3:BlockR2:AA4:BB1	-25.8	56.329	240	-0.4571	0.647990
Site3:BlockR2:AA4:BB2	25.0	56.329	240	0.4438	0.657574
Site3:BlockR2:AA5:BB1	0.0	56.329	240	0.0000	1.000000
Site3:BlockR2:AA5:BB2	0.0	0.000	240		
Site3:BlockR3:AA1:BB1	0.0	0.000	240		

Site3:BlockR3:AA1:BB2	0.0	0.000	240		
Site3:BlockR3:AA2:BB1	0.0	0.000	240		
Site3:BlockR3:AA2:BB2	0.0	0.000	240		
Site3:BlockR3:AA3:BB1	0.0	0.000	240		
Site3:BlockR3:AA3:BB2	0.0	0.000	240		
Site3:BlockR3:AA4:BB1	0.0	0.000	240		
Site3:BlockR3:AA4:BB2	0.0	0.000	240		
Site3:BlockR3:AA5:BB1	0.0	0.000	240		
Site3:BlockR3:AA5:BB2	0.0	0.000	240		
Site4:BlockR1:AA1:BB1	38.7	56.329	240	0.6879	0.492169
Site4:BlockR1:AA1:BB2	6.5	56.329	240	0.1154	0.908230
Site4:BlockR1:AA2:BB1	17.5	56.329	240	0.3107	0.756319
Site4:BlockR1:AA2:BB2	-13.0	56.329	240	-0.2308	0.817678
Site4:BlockR1:AA3:BB1	61.5	56.329	240	1.0918	0.276020
Site4:BlockR1:AA3:BB2	-32.3	56.329	240	-0.5725	0.567503
Site4:BlockR1:AA4:BB1	33.0	56.329	240	0.5858	0.558534
Site4:BlockR1:AA4:BB2	25.0	56.329	240	0.4438	0.657574
Site4:BlockR1:AA5:BB1	75.0	56.329	240	1.3315	0.184303
Site4:BlockR1:AA5:BB2	0.0	0.000	240		
Site4:BlockR2:AA1:BB1	-69.8	56.329	240	-1.2383	0.216833
Site4:BlockR2:AA1:BB2	-36.5	56.329	240	-0.6480	0.517622
Site4:BlockR2:AA2:BB1	-53.8	56.329	240	-0.9542	0.340939
Site4:BlockR2:AA2:BB2	-14.3	56.329	240	-0.2530	0.800503
Site4:BlockR2:AA3:BB1	-62.3	56.329	240	-1.1051	0.270221
Site4:BlockR2:AA3:BB2	-104.5	56.329	240	-1.8552	0.064800
Site4:BlockR2:AA4:BB1	-3.8	56.329	240	-0.0666	0.946977
Site4:BlockR2:AA4:BB2	0.0	56.329	240	0.0000	1.000000
Site4:BlockR2:AA5:BB1	25.0	56.329	240	0.4438	0.657574
Site4:BlockR2:AA5:BB2	0.0	0.000	240		
Site4:BlockR3:AA1:BB1	0.0	0.000	240		
Site4:BlockR3:AA1:BB2	0.0	0.000	240		
Site4:BlockR3:AA2:BB1	0.0	0.000	240		
Site4:BlockR3:AA2:BB2	0.0	0.000	240		
Site4:BlockR3:AA3:BB1	0.0	0.000	240		
Site4:BlockR3:AA3:BB2	0.0	0.000	240		
Site4:BlockR3:AA4:BB1	0.0	0.000	240		
Site4:BlockR3:AA4:BB2	0.0	0.000	240		
Site4:BlockR3:AA5:BB1	0.0	0.000	240		
Site4:BlockR3:AA5:BB2	0.0	0.000	240		
CC1	-1066.7	45.993	240	-23.1920	< 2.2e-16 ***
CC2	-733.3	45.993	240	-15.9445	< 2.2e-16 ***
CC3	-533.3	45.993	240	-11.5960	< 2.2e-16 ***
CC4	0.0	0.000	240		
AA1:CC1	1551.3	65.044	240	23.8506	< 2.2e-16 ***
AA1:CC2	137.7	65.044	240	2.1165	0.035330 *
AA1:CC3	201.0	65.044	240	3.0902	0.002236 **
AA1:CC4	0.0	0.000	240		
AA2:CC1	1877.7	65.044	240	28.8678	< 2.2e-16 ***

AA2:CC2	1858.7	65.044	240	28.5757	< 2.2e-16	***
AA2:CC3	1936.7	65.044	240	29.7749	< 2.2e-16	***
AA2:CC4	0.0	0.000	240			
AA3:CC1	1915.7	65.044	240	29.4520	< 2.2e-16	***
AA3:CC2	1315.7	65.044	240	20.2274	< 2.2e-16	***
AA3:CC3	815.7	65.044	240	12.5403	< 2.2e-16	***
AA3:CC4	0.0	0.000	240			
AA4:CC1	-66.7	65.044	240	-1.0250	0.306418	
AA4:CC2	1200.0	65.044	240	18.4491	< 2.2e-16	***
AA4:CC3	833.3	65.044	240	12.8119	< 2.2e-16	***
AA4:CC4	0.0	0.000	240			
AA5:CC1	0.0	0.000	240			
AA5:CC2	0.0	0.000	240			
AA5:CC3	0.0	0.000	240			
AA5:CC4	0.0	0.000	240			
BB1:CC1	733.3	65.044	240	11.2745	< 2.2e-16	***
BB1:CC2	166.7	65.044	240	2.5624	0.011007	*
BB1:CC3	200.0	65.044	240	3.0749	0.002350	**
BB1:CC4	0.0	0.000	240			
BB2:CC1	0.0	0.000	240			
BB2:CC2	0.0	0.000	240			
BB2:CC3	0.0	0.000	240			
BB2:CC4	0.0	0.000	240			
AA1:BB1:CC1	-2102.0	91.986	240	-22.8514	< 2.2e-16	***
AA1:BB1:CC2	-122.3	91.986	240	-1.3299	0.184808	
AA1:BB1:CC3	-116.7	91.986	240	-1.2683	0.205915	
AA1:BB1:CC4	0.0	0.000	240			
AA1:BB2:CC1	0.0	0.000	240			
AA1:BB2:CC2	0.0	0.000	240			
AA1:BB2:CC3	0.0	0.000	240			
AA1:BB2:CC4	0.0	0.000	240			
AA2:BB1:CC1	-2365.3	91.986	240	-25.7142	< 2.2e-16	***
AA2:BB1:CC2	-1887.7	91.986	240	-20.5213	< 2.2e-16	***
AA2:BB1:CC3	-1849.3	91.986	240	-20.1046	< 2.2e-16	***
AA2:BB1:CC4	0.0	0.000	240			
AA2:BB2:CC1	0.0	0.000	240			
AA2:BB2:CC2	0.0	0.000	240			
AA2:BB2:CC3	0.0	0.000	240			
AA2:BB2:CC4	0.0	0.000	240			
AA3:BB1:CC1	-4088.7	91.986	240	-44.4490	< 2.2e-16	***
AA3:BB1:CC2	-2939.3	91.986	240	-31.9543	< 2.2e-16	***
AA3:BB1:CC3	-2384.3	91.986	240	-25.9207	< 2.2e-16	***
AA3:BB1:CC4	0.0	0.000	240			
AA3:BB2:CC1	0.0	0.000	240			
AA3:BB2:CC2	0.0	0.000	240			
AA3:BB2:CC3	0.0	0.000	240			
AA3:BB2:CC4	0.0	0.000	240			
AA4:BB1:CC1	-561.0	91.986	240	-6.0988	4.243e-09	***

AA4:BB1:CC2	-1233.3	91.986	240	-13.4079	< 2.2e-16	***
AA4:BB1:CC3	-833.3	91.986	240	-9.0594	< 2.2e-16	***
AA4:BB1:CC4	0.0	0.000	240			
AA4:BB2:CC1	0.0	0.000	240			
AA4:BB2:CC2	0.0	0.000	240			
AA4:BB2:CC3	0.0	0.000	240			
AA4:BB2:CC4	0.0	0.000	240			
AA5:BB1:CC1	0.0	0.000	240			
AA5:BB1:CC2	0.0	0.000	240			
AA5:BB1:CC3	0.0	0.000	240			
AA5:BB1:CC4	0.0	0.000	240			
AA5:BB2:CC1	0.0	0.000	240			
AA5:BB2:CC2	0.0	0.000	240			
AA5:BB2:CC3	0.0	0.000	240			
AA5:BB2:CC4	0.0	0.000	240			
Site1:CC1	100.0	65.044	240	1.5374	0.125506	
Site1:CC2	33.3	65.044	240	0.5125	0.608789	
Site1:CC3	0.0	65.044	240	0.0000	1.000000	
Site1:CC4	0.0	0.000	240			
Site2:CC1	133.3	65.044	240	2.0499	0.041461	*
Site2:CC2	133.3	65.044	240	2.0499	0.041461	*
Site2:CC3	66.7	65.044	240	1.0250	0.306418	
Site2:CC4	0.0	0.000	240			
Site3:CC1	66.7	65.044	240	1.0250	0.306418	
Site3:CC2	0.0	65.044	240	0.0000	1.000000	
Site3:CC3	0.0	65.044	240	0.0000	1.000000	
Site3:CC4	0.0	0.000	240			
Site4:CC1	0.0	0.000	240			
Site4:CC2	0.0	0.000	240			
Site4:CC3	0.0	0.000	240			
Site4:CC4	0.0	0.000	240			
Site1:AA1:CC1	-136.7	91.986	240	-1.4857	0.138660	
Site1:AA1:CC2	-33.7	91.986	240	-0.3660	0.714688	
Site1:AA1:CC3	39.0	91.986	240	0.4240	0.671961	
Site1:AA1:CC4	0.0	0.000	240			
Site1:AA2:CC1	-173.3	91.986	240	-1.8844	0.060726	.
Site1:AA2:CC2	-174.3	91.986	240	-1.8952	0.059265	.
Site1:AA2:CC3	0.7	91.986	240	0.0072	0.994223	
Site1:AA2:CC4	0.0	0.000	240			
Site1:AA3:CC1	-198.7	91.986	240	-2.1598	0.031782	*
Site1:AA3:CC2	-132.0	91.986	240	-1.4350	0.152587	
Site1:AA3:CC3	-65.3	91.986	240	-0.7103	0.478235	
Site1:AA3:CC4	0.0	0.000	240			
Site1:AA4:CC1	-33.3	91.986	240	-0.3624	0.717390	
Site1:AA4:CC2	0.0	91.986	240	0.0000	1.000000	
Site1:AA4:CC3	0.0	91.986	240	0.0000	1.000000	
Site1:AA4:CC4	0.0	0.000	240			
Site1:AA5:CC1	0.0	0.000	240			

Site1:AA5:CC2	0.0	0.000	240		
Site1:AA5:CC3	0.0	0.000	240		
Site1:AA5:CC4	0.0	0.000	240		
Site2:AA1:CC1	-180.3	91.986	240	-1.9605	0.051100 .
Site2:AA1:CC2	-81.3	91.986	240	-0.8842	0.377475
Site2:AA1:CC3	-47.0	91.986	240	-0.5109	0.609856
Site2:AA1:CC4	0.0	0.000	240		
Site2:AA2:CC1	-196.7	91.986	240	-2.1380	0.033526 *
Site2:AA2:CC2	-179.3	91.986	240	-1.9496	0.052391 .
Site2:AA2:CC3	-124.7	91.986	240	-1.3553	0.176601
Site2:AA2:CC4	0.0	0.000	240		
Site2:AA3:CC1	-85.3	91.986	240	-0.9277	0.354505
Site2:AA3:CC2	-85.3	91.986	240	-0.9277	0.354505
Site2:AA3:CC3	-52.0	91.986	240	-0.5653	0.572394
Site2:AA3:CC4	0.0	0.000	240		
Site2:AA4:CC1	-33.3	91.986	240	-0.3624	0.717390
Site2:AA4:CC2	0.0	91.986	240	0.0000	1.000000
Site2:AA4:CC3	33.3	91.986	240	0.3624	0.717390
Site2:AA4:CC4	0.0	0.000	240		
Site2:AA5:CC1	0.0	0.000	240		
Site2:AA5:CC2	0.0	0.000	240		
Site2:AA5:CC3	0.0	0.000	240		
Site2:AA5:CC4	0.0	0.000	240		
Site3:AA1:CC1	-138.7	91.986	240	-1.5075	0.133002
Site3:AA1:CC2	-83.0	91.986	240	-0.9023	0.367794
Site3:AA1:CC3	-104.0	91.986	240	-1.1306	0.259347
Site3:AA1:CC4	0.0	0.000	240		
Site3:AA2:CC1	-61.7	91.986	240	-0.6704	0.503251
Site3:AA2:CC2	-71.7	91.986	240	-0.7791	0.436684
Site3:AA2:CC3	-68.0	91.986	240	-0.7392	0.460480
Site3:AA2:CC4	0.0	0.000	240		
Site3:AA3:CC1	-115.7	91.986	240	-1.2574	0.209816
Site3:AA3:CC2	-15.7	91.986	240	-0.1703	0.864905
Site3:AA3:CC3	-15.7	91.986	240	-0.1703	0.864905
Site3:AA3:CC4	0.0	0.000	240		
Site3:AA4:CC1	33.3	91.986	240	0.3624	0.717390
Site3:AA4:CC2	0.0	91.986	240	0.0000	1.000000
Site3:AA4:CC3	33.3	91.986	240	0.3624	0.717390
Site3:AA4:CC4	0.0	0.000	240		
Site3:AA5:CC1	0.0	0.000	240		
Site3:AA5:CC2	0.0	0.000	240		
Site3:AA5:CC3	0.0	0.000	240		
Site3:AA5:CC4	0.0	0.000	240		
Site4:AA1:CC1	0.0	0.000	240		
Site4:AA1:CC2	0.0	0.000	240		
Site4:AA1:CC3	0.0	0.000	240		
Site4:AA1:CC4	0.0	0.000	240		
Site4:AA2:CC1	0.0	0.000	240		

Site4:AA2:CC2	0.0	0.000	240		
Site4:AA2:CC3	0.0	0.000	240		
Site4:AA2:CC4	0.0	0.000	240		
Site4:AA3:CC1	0.0	0.000	240		
Site4:AA3:CC2	0.0	0.000	240		
Site4:AA3:CC3	0.0	0.000	240		
Site4:AA3:CC4	0.0	0.000	240		
Site4:AA4:CC1	0.0	0.000	240		
Site4:AA4:CC2	0.0	0.000	240		
Site4:AA4:CC3	0.0	0.000	240		
Site4:AA4:CC4	0.0	0.000	240		
Site4:AA5:CC1	0.0	0.000	240		
Site4:AA5:CC2	0.0	0.000	240		
Site4:AA5:CC3	0.0	0.000	240		
Site4:AA5:CC4	0.0	0.000	240		
Site1:BB1:CC1	0.0	91.986	240	0.0000	1.000000
Site1:BB1:CC2	33.3	91.986	240	0.3624	0.717390
Site1:BB1:CC3	33.3	91.986	240	0.3624	0.717390
Site1:BB1:CC4	0.0	0.000	240		
Site1:BB2:CC1	0.0	0.000	240		
Site1:BB2:CC2	0.0	0.000	240		
Site1:BB2:CC3	0.0	0.000	240		
Site1:BB2:CC4	0.0	0.000	240		
Site2:BB1:CC1	-166.7	91.986	240	-1.8119	0.071255 .
Site2:BB1:CC2	-200.0	91.986	240	-2.1743	0.030664 *
Site2:BB1:CC3	-233.3	91.986	240	-2.5366	0.011827 *
Site2:BB1:CC4	0.0	0.000	240		
Site2:BB2:CC1	0.0	0.000	240		
Site2:BB2:CC2	0.0	0.000	240		
Site2:BB2:CC3	0.0	0.000	240		
Site2:BB2:CC4	0.0	0.000	240		
Site3:BB1:CC1	33.3	91.986	240	0.3624	0.717390
Site3:BB1:CC2	33.3	91.986	240	0.3624	0.717390
Site3:BB1:CC3	-66.7	91.986	240	-0.7248	0.469311
Site3:BB1:CC4	0.0	0.000	240		
Site3:BB2:CC1	0.0	0.000	240		
Site3:BB2:CC2	0.0	0.000	240		
Site3:BB2:CC3	0.0	0.000	240		
Site3:BB2:CC4	0.0	0.000	240		
Site4:BB1:CC1	0.0	0.000	240		
Site4:BB1:CC2	0.0	0.000	240		
Site4:BB1:CC3	0.0	0.000	240		
Site4:BB1:CC4	0.0	0.000	240		
Site4:BB2:CC1	0.0	0.000	240		
Site4:BB2:CC2	0.0	0.000	240		
Site4:BB2:CC3	0.0	0.000	240		
Site4:BB2:CC4	0.0	0.000	240		
Site1:AA1:BB1:CC1	76.3	130.087	240	0.5868	0.557899

Site1:AA1:BB1:CC2	-48.0	130.087	240	-0.3690	0.712466
Site1:AA1:BB1:CC3	-105.3	130.087	240	-0.8097	0.418908
Site1:AA1:BB1:CC4	0.0	0.000	240		
Site1:AA1:BB2:CC1	0.0	0.000	240		
Site1:AA1:BB2:CC2	0.0	0.000	240		
Site1:AA1:BB2:CC3	0.0	0.000	240		
Site1:AA1:BB2:CC4	0.0	0.000	240		
Site1:AA2:BB1:CC1	12.3	130.087	240	0.0948	0.924546
Site1:AA2:BB1:CC2	120.0	130.087	240	0.9225	0.357217
Site1:AA2:BB1:CC3	-23.7	130.087	240	-0.1819	0.855792
Site1:AA2:BB1:CC4	0.0	0.000	240		
Site1:AA2:BB2:CC1	0.0	0.000	240		
Site1:AA2:BB2:CC2	0.0	0.000	240		
Site1:AA2:BB2:CC3	0.0	0.000	240		
Site1:AA2:BB2:CC4	0.0	0.000	240		
Site1:AA3:BB1:CC1	202.7	130.087	240	1.5579	0.120568
Site1:AA3:BB1:CC2	100.3	130.087	240	0.7713	0.441302
Site1:AA3:BB1:CC3	29.7	130.087	240	0.2281	0.819800
Site1:AA3:BB1:CC4	0.0	0.000	240		
Site1:AA3:BB2:CC1	0.0	0.000	240		
Site1:AA3:BB2:CC2	0.0	0.000	240		
Site1:AA3:BB2:CC3	0.0	0.000	240		
Site1:AA3:BB2:CC4	0.0	0.000	240		
Site1:AA4:BB1:CC1	-13.7	130.087	240	-0.1051	0.916418
Site1:AA4:BB1:CC2	-70.0	130.087	240	-0.5381	0.591007
Site1:AA4:BB1:CC3	-66.7	130.087	240	-0.5125	0.608789
Site1:AA4:BB1:CC4	0.0	0.000	240		
Site1:AA4:BB2:CC1	0.0	0.000	240		
Site1:AA4:BB2:CC2	0.0	0.000	240		
Site1:AA4:BB2:CC3	0.0	0.000	240		
Site1:AA4:BB2:CC4	0.0	0.000	240		
Site1:AA5:BB1:CC1	0.0	0.000	240		
Site1:AA5:BB1:CC2	0.0	0.000	240		
Site1:AA5:BB1:CC3	0.0	0.000	240		
Site1:AA5:BB1:CC4	0.0	0.000	240		
Site1:AA5:BB2:CC1	0.0	0.000	240		
Site1:AA5:BB2:CC2	0.0	0.000	240		
Site1:AA5:BB2:CC3	0.0	0.000	240		
Site1:AA5:BB2:CC4	0.0	0.000	240		
Site2:AA1:BB1:CC1	215.3	130.087	240	1.6553	0.099171
Site2:AA1:BB1:CC2	92.7	130.087	240	0.7123	0.476945
Site2:AA1:BB1:CC3	122.0	130.087	240	0.9378	0.349274
Site2:AA1:BB1:CC4	0.0	0.000	240		
Site2:AA1:BB2:CC1	0.0	0.000	240		
Site2:AA1:BB2:CC2	0.0	0.000	240		
Site2:AA1:BB2:CC3	0.0	0.000	240		
Site2:AA1:BB2:CC4	0.0	0.000	240		
Site2:AA2:BB1:CC1	143.0	130.087	240	1.0993	0.272755

Site2:AA2:BB1:CC2	186.0	130.087	240	1.4298	0.154072
Site2:AA2:BB1:CC3	288.7	130.087	240	2.2190	0.027421 *
Site2:AA2:BB1:CC4	0.0	0.000	240		
Site2:AA2:BB2:CC1	0.0	0.000	240		
Site2:AA2:BB2:CC2	0.0	0.000	240		
Site2:AA2:BB2:CC3	0.0	0.000	240		
Site2:AA2:BB2:CC4	0.0	0.000	240		
Site2:AA3:BB1:CC1	195.7	130.087	240	1.5041	0.133866
Site2:AA3:BB1:CC2	143.0	130.087	240	1.0993	0.272755
Site2:AA3:BB1:CC3	203.3	130.087	240	1.5631	0.119358
Site2:AA3:BB1:CC4	0.0	0.000	240		
Site2:AA3:BB2:CC1	0.0	0.000	240		
Site2:AA3:BB2:CC2	0.0	0.000	240		
Site2:AA3:BB2:CC3	0.0	0.000	240		
Site2:AA3:BB2:CC4	0.0	0.000	240		
Site2:AA4:BB1:CC1	136.3	130.087	240	1.0480	0.295686
Site2:AA4:BB1:CC2	59.0	130.087	240	0.4535	0.650569
Site2:AA4:BB1:CC3	66.7	130.087	240	0.5125	0.608789
Site2:AA4:BB1:CC4	0.0	0.000	240		
Site2:AA4:BB2:CC1	0.0	0.000	240		
Site2:AA4:BB2:CC2	0.0	0.000	240		
Site2:AA4:BB2:CC3	0.0	0.000	240		
Site2:AA4:BB2:CC4	0.0	0.000	240		
Site2:AA5:BB1:CC1	0.0	0.000	240		
Site2:AA5:BB1:CC2	0.0	0.000	240		
Site2:AA5:BB1:CC3	0.0	0.000	240		
Site2:AA5:BB1:CC4	0.0	0.000	240		
Site2:AA5:BB2:CC1	0.0	0.000	240		
Site2:AA5:BB2:CC2	0.0	0.000	240		
Site2:AA5:BB2:CC3	0.0	0.000	240		
Site2:AA5:BB2:CC4	0.0	0.000	240		
Site3:AA1:BB1:CC1	42.0	130.087	240	0.3229	0.747082
Site3:AA1:BB1:CC2	-74.0	130.087	240	-0.5688	0.569991
Site3:AA1:BB1:CC3	96.3	130.087	240	0.7405	0.459703
Site3:AA1:BB1:CC4	0.0	0.000	240		
Site3:AA1:BB2:CC1	0.0	0.000	240		
Site3:AA1:BB2:CC2	0.0	0.000	240		
Site3:AA1:BB2:CC3	0.0	0.000	240		
Site3:AA1:BB2:CC4	0.0	0.000	240		
Site3:AA2:BB1:CC1	-113.3	130.087	240	-0.8712	0.384510
Site3:AA2:BB1:CC2	9.0	130.087	240	0.0692	0.944901
Site3:AA2:BB1:CC3	83.7	130.087	240	0.6432	0.520736
Site3:AA2:BB1:CC4	0.0	0.000	240		
Site3:AA2:BB2:CC1	0.0	0.000	240		
Site3:AA2:BB2:CC2	0.0	0.000	240		
Site3:AA2:BB2:CC3	0.0	0.000	240		
Site3:AA2:BB2:CC4	0.0	0.000	240		
Site3:AA3:BB1:CC1	36.3	130.087	240	0.2793	0.780255

Site3:AA3:BB1:CC2	-46.7	130.087	240	-0.3587	0.720110
Site3:AA3:BB1:CC3	82.0	130.087	240	0.6303	0.529068
Site3:AA3:BB1:CC4	0.0	0.000	240		
Site3:AA3:BB2:CC1	0.0	0.000	240		
Site3:AA3:BB2:CC2	0.0	0.000	240		
Site3:AA3:BB2:CC3	0.0	0.000	240		
Site3:AA3:BB2:CC4	0.0	0.000	240		
Site3:AA4:BB1:CC1	-89.0	130.087	240	-0.6842	0.494537
Site3:AA4:BB1:CC2	-100.0	130.087	240	-0.7687	0.442819
Site3:AA4:BB1:CC3	33.3	130.087	240	0.2562	0.797986
Site3:AA4:BB1:CC4	0.0	0.000	240		
Site3:AA4:BB2:CC1	0.0	0.000	240		
Site3:AA4:BB2:CC2	0.0	0.000	240		
Site3:AA4:BB2:CC3	0.0	0.000	240		
Site3:AA4:BB2:CC4	0.0	0.000	240		
Site3:AA5:BB1:CC1	0.0	0.000	240		
Site3:AA5:BB1:CC2	0.0	0.000	240		
Site3:AA5:BB1:CC3	0.0	0.000	240		
Site3:AA5:BB1:CC4	0.0	0.000	240		
Site3:AA5:BB2:CC1	0.0	0.000	240		
Site3:AA5:BB2:CC2	0.0	0.000	240		
Site3:AA5:BB2:CC3	0.0	0.000	240		
Site3:AA5:BB2:CC4	0.0	0.000	240		
Site4:AA1:BB1:CC1	0.0	0.000	240		
Site4:AA1:BB1:CC2	0.0	0.000	240		
Site4:AA1:BB1:CC3	0.0	0.000	240		
Site4:AA1:BB1:CC4	0.0	0.000	240		
Site4:AA1:BB2:CC1	0.0	0.000	240		
Site4:AA1:BB2:CC2	0.0	0.000	240		
Site4:AA1:BB2:CC3	0.0	0.000	240		
Site4:AA1:BB2:CC4	0.0	0.000	240		
Site4:AA2:BB1:CC1	0.0	0.000	240		
Site4:AA2:BB1:CC2	0.0	0.000	240		
Site4:AA2:BB1:CC3	0.0	0.000	240		
Site4:AA2:BB1:CC4	0.0	0.000	240		
Site4:AA2:BB2:CC1	0.0	0.000	240		
Site4:AA2:BB2:CC2	0.0	0.000	240		
Site4:AA2:BB2:CC3	0.0	0.000	240		
Site4:AA2:BB2:CC4	0.0	0.000	240		
Site4:AA3:BB1:CC1	0.0	0.000	240		
Site4:AA3:BB1:CC2	0.0	0.000	240		
Site4:AA3:BB1:CC3	0.0	0.000	240		
Site4:AA3:BB1:CC4	0.0	0.000	240		
Site4:AA3:BB2:CC1	0.0	0.000	240		
Site4:AA3:BB2:CC2	0.0	0.000	240		
Site4:AA3:BB2:CC3	0.0	0.000	240		
Site4:AA3:BB2:CC4	0.0	0.000	240		
Site4:AA4:BB1:CC1	0.0	0.000	240		

```

Site4:AA4:BB1:CC2      0.0      0.000 240
Site4:AA4:BB1:CC3      0.0      0.000 240
Site4:AA4:BB1:CC4      0.0      0.000 240
Site4:AA4:BB2:CC1      0.0      0.000 240
Site4:AA4:BB2:CC2      0.0      0.000 240
Site4:AA4:BB2:CC3      0.0      0.000 240
Site4:AA4:BB2:CC4      0.0      0.000 240
Site4:AA5:BB1:CC1      0.0      0.000 240
Site4:AA5:BB1:CC2      0.0      0.000 240
Site4:AA5:BB1:CC3      0.0      0.000 240
Site4:AA5:BB1:CC4      0.0      0.000 240
Site4:AA5:BB2:CC1      0.0      0.000 240
Site4:AA5:BB2:CC2      0.0      0.000 240
Site4:AA5:BB2:CC3      0.0      0.000 240
Site4:AA5:BB2:CC4      0.0      0.000 240

```

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

```

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

```
ex10.2 = read.table("C:/G/Rt/Split/Ex10.2-spbsite.txt", header=TRUE)
ex10.2 = af(ex10.2, c("Site", "Block", "A", "B"))
GLM(Yield ~ Site + Site:Block + A + A:Site + A:Site:Block + B + B:Site +
      B:Site:Block + A:B + A:B:Site, ex10.2)
```

\$ANOVA

Response : Yield

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	227	6370995084	28066058	10814	< 2.2e-16 ***
RESIDUALS	252	654049	2595		
CORRECTED TOTAL	479	6371649132			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Site	2	523573968	261786984	1.0086e+05	< 2.2e-16 ***
Site:Block	9	3756646710	417405190	1.6082e+05	< 2.2e-16 ***
A	4	29288163	7322041	2.8211e+03	< 2.2e-16 ***
Site:A	8	247899	30987	1.1939e+01	1.998e-14 ***
Site:Block:A	36	1783391	49539	1.9087e+01	< 2.2e-16 ***
B	7	1937592291	276798899	1.0665e+05	< 2.2e-16 ***
Site:B	14	15903698	1135978	4.3768e+02	< 2.2e-16 ***
Site:Block:B	63	105727288	1678211	6.4660e+02	< 2.2e-16 ***
A:B	28	91141	3255	1.2541e+00	0.1838
Site:A:B	56	140534	2510	9.6690e-01	0.5461

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Site	2	523573968	261786984	1.0086e+05	< 2.2e-16 ***
Site:Block	9	3756646710	417405190	1.6082e+05	< 2.2e-16 ***
A	4	29288163	7322041	2.8211e+03	< 2.2e-16 ***
Site:A	8	247899	30987	1.1939e+01	1.998e-14 ***
Site:Block:A	36	1783391	49539	1.9087e+01	< 2.2e-16 ***
B	7	1937592291	276798899	1.0665e+05	< 2.2e-16 ***
Site:B	14	15903698	1135978	4.3768e+02	< 2.2e-16 ***
Site:Block:B	63	105727288	1678211	6.4660e+02	< 2.2e-16 ***
A:B	28	91141	3255	1.2541e+00	0.1838
Site:A:B	56	140534	2510	9.6690e-01	0.5461

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Site	2	523573968	261786984	1.0086e+05	< 2.2e-16 ***
Site:Block	9	3756646710	417405190	1.6082e+05	< 2.2e-16 ***
A	4	29288163	7322041	2.8211e+03	< 2.2e-16 ***
Site:A	8	247899	30987	1.1939e+01	1.998e-14 ***
Site:Block:A	36	1783391	49539	1.9087e+01	< 2.2e-16 ***
B	7	1937592291	276798899	1.0665e+05	< 2.2e-16 ***
Site:B	14	15903698	1135978	4.3768e+02	< 2.2e-16 ***
Site:Block:B	63	105727288	1678211	6.4660e+02	< 2.2e-16 ***
A:B	28	91141	3255	1.2541e+00	0.1838
Site:A:B	56	140534	2510	9.6690e-01	0.5461

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	13975.4	35.112	252	398.0266	< 2.2e-16 ***
Site1	-3964.6	49.655	252	-79.8426	< 2.2e-16 ***
Site2	-6027.2	49.655	252	-121.3814	< 2.2e-16 ***
Site3	0.0	0.000	252		
Site1:BlockR1	5969.7	39.462	252	151.2767	< 2.2e-16 ***
Site1:BlockR2	3993.2	39.462	252	101.1914	< 2.2e-16 ***
Site1:BlockR3	7976.0	39.462	252	202.1185	< 2.2e-16 ***
Site1:BlockR4	0.0	0.000	252		
Site2:BlockR1	1983.1	39.462	252	50.2533	< 2.2e-16 ***
Site2:BlockR2	8050.7	39.462	252	204.0115	< 2.2e-16 ***
Site2:BlockR3	9979.6	39.462	252	252.8913	< 2.2e-16 ***
Site2:BlockR4	0.0	0.000	252		
Site3:BlockR1	-1977.8	39.462	252	-50.1183	< 2.2e-16 ***
Site3:BlockR2	4028.8	39.462	252	102.0941	< 2.2e-16 ***
Site3:BlockR3	6011.4	39.462	252	152.3335	< 2.2e-16 ***
Site3:BlockR4	0.0	0.000	252		
AA1	-558.7	42.242	252	-13.2267	< 2.2e-16 ***
AA2	-438.8	42.242	252	-10.3889	< 2.2e-16 ***
AA3	-240.1	42.242	252	-5.6838	3.632e-08 ***
AA4	-153.3	42.242	252	-3.6279	0.0003458 ***
AA5	0.0	0.000	252		
Site1:AA1	-38.1	59.739	252	-0.6377	0.5242659
Site1:AA2	0.8	59.739	252	0.0131	0.9895761
Site1:AA3	-98.2	59.739	252	-1.6436	0.1015027
Site1:AA4	-21.4	59.739	252	-0.3583	0.7203955
Site1:AA5	0.0	0.000	252		
Site2:AA1	413.1	59.739	252	6.9145	3.844e-11 ***
Site2:AA2	368.4	59.739	252	6.1670	2.752e-09 ***
Site2:AA3	138.4	59.739	252	2.3163	0.0213427 *
Site2:AA4	164.4	59.739	252	2.7516	0.0063618 **

Site2:AA5	0.0	0.000	252			
Site3:AA1	0.0	0.000	252			
Site3:AA2	0.0	0.000	252			
Site3:AA3	0.0	0.000	252			
Site3:AA4	0.0	0.000	252			
Site3:AA5	0.0	0.000	252			
Site1:BlockR1:AA1	-190.6	36.024	252	-5.2916	2.635e-07	***
Site1:BlockR1:AA2	-131.1	36.024	252	-3.6400	0.0003308	***
Site1:BlockR1:AA3	-76.1	36.024	252	-2.1132	0.0355682	*
Site1:BlockR1:AA4	-52.6	36.024	252	-1.4608	0.1453053	
Site1:BlockR1:AA5	0.0	0.000	252			
Site1:BlockR2:AA1	-188.1	36.024	252	-5.2222	3.702e-07	***
Site1:BlockR2:AA2	-148.4	36.024	252	-4.1188	5.168e-05	***
Site1:BlockR2:AA3	-43.6	36.024	252	-1.2110	0.2270282	
Site1:BlockR2:AA4	-33.0	36.024	252	-0.9161	0.3605109	
Site1:BlockR2:AA5	0.0	0.000	252			
Site1:BlockR3:AA1	-234.0	36.024	252	-6.4957	4.379e-10	***
Site1:BlockR3:AA2	-133.3	36.024	252	-3.6989	0.0002658	***
Site1:BlockR3:AA3	-82.1	36.024	252	-2.2797	0.0234592	*
Site1:BlockR3:AA4	-87.8	36.024	252	-2.4359	0.0155490	*
Site1:BlockR3:AA5	0.0	0.000	252			
Site1:BlockR4:AA1	0.0	0.000	252			
Site1:BlockR4:AA2	0.0	0.000	252			
Site1:BlockR4:AA3	0.0	0.000	252			
Site1:BlockR4:AA4	0.0	0.000	252			
Site1:BlockR4:AA5	0.0	0.000	252			
Site2:BlockR1:AA1	-382.5	36.024	252	-10.6180	< 2.2e-16	***
Site2:BlockR1:AA2	-261.9	36.024	252	-7.2695	4.528e-12	***
Site2:BlockR1:AA3	-171.6	36.024	252	-4.7642	3.204e-06	***
Site2:BlockR1:AA4	-74.5	36.024	252	-2.0681	0.0396533	*
Site2:BlockR1:AA5	0.0	0.000	252			
Site2:BlockR2:AA1	-634.4	36.024	252	-17.6099	< 2.2e-16	***
Site2:BlockR2:AA2	-508.7	36.024	252	-14.1226	< 2.2e-16	***
Site2:BlockR2:AA3	-288.9	36.024	252	-8.0190	3.997e-14	***
Site2:BlockR2:AA4	-183.6	36.024	252	-5.0973	6.768e-07	***
Site2:BlockR2:AA5	0.0	0.000	252			
Site2:BlockR3:AA1	-607.5	36.024	252	-16.8638	< 2.2e-16	***
Site2:BlockR3:AA2	-466.6	36.024	252	-12.9532	< 2.2e-16	***
Site2:BlockR3:AA3	-249.6	36.024	252	-6.9294	3.517e-11	***
Site2:BlockR3:AA4	-166.4	36.024	252	-4.6185	6.169e-06	***
Site2:BlockR3:AA5	0.0	0.000	252			
Site2:BlockR4:AA1	0.0	0.000	252			
Site2:BlockR4:AA2	0.0	0.000	252			
Site2:BlockR4:AA3	0.0	0.000	252			
Site2:BlockR4:AA4	0.0	0.000	252			
Site2:BlockR4:AA5	0.0	0.000	252			
Site3:BlockR1:AA1	11.6	36.024	252	0.3227	0.7471876	
Site3:BlockR1:AA2	-27.1	36.024	252	-0.7530	0.4521683	

Site3:BlockR1:AA3	-8.9	36.024	252	-0.2464	0.8056004	
Site3:BlockR1:AA4	51.3	36.024	252	1.4227	0.1560685	
Site3:BlockR1:AA5	0.0	0.000	252			
Site3:BlockR2:AA1	-237.6	36.024	252	-6.5963	2.463e-10	***
Site3:BlockR2:AA2	-200.2	36.024	252	-5.5588	6.907e-08	***
Site3:BlockR2:AA3	-142.0	36.024	252	-3.9418	0.0001048	***
Site3:BlockR2:AA4	-55.4	36.024	252	-1.5372	0.1255045	
Site3:BlockR2:AA5	0.0	0.000	252			
Site3:BlockR3:AA1	-207.1	36.024	252	-5.7497	2.578e-08	***
Site3:BlockR3:AA2	-232.2	36.024	252	-6.4471	5.769e-10	***
Site3:BlockR3:AA3	-127.7	36.024	252	-3.5463	0.0004657	***
Site3:BlockR3:AA4	-66.9	36.024	252	-1.8564	0.0645621	.
Site3:BlockR3:AA5	0.0	0.000	252			
Site3:BlockR4:AA1	0.0	0.000	252			
Site3:BlockR4:AA2	0.0	0.000	252			
Site3:BlockR4:AA3	0.0	0.000	252			
Site3:BlockR4:AA4	0.0	0.000	252			
Site3:BlockR4:AA5	0.0	0.000	252			
BB1	-5364.0	45.567	252	-117.7159	< 2.2e-16	***
BB2	-4564.7	45.567	252	-100.1746	< 2.2e-16	***
BB3	-3808.6	45.567	252	-83.5815	< 2.2e-16	***
BB4	-3070.7	45.567	252	-67.3877	< 2.2e-16	***
BB5	-2308.1	45.567	252	-50.6519	< 2.2e-16	***
BB6	-1561.6	45.567	252	-34.2694	< 2.2e-16	***
BB7	-704.7	45.567	252	-15.4641	< 2.2e-16	***
BB8	0.0	0.000	252			
Site1:BB1	-87.2	64.441	252	-1.3539	0.1769672	
Site1:BB2	-63.8	64.441	252	-0.9900	0.3231006	
Site1:BB3	-48.9	64.441	252	-0.7588	0.4486638	
Site1:BB4	-16.6	64.441	252	-0.2576	0.7969270	
Site1:BB5	17.3	64.441	252	0.2677	0.7891606	
Site1:BB6	16.3	64.441	252	0.2529	0.8005184	
Site1:BB7	-127.0	64.441	252	-1.9716	0.0497538	*
Site1:BB8	0.0	0.000	252			
Site2:BB1	3583.2	64.441	252	55.6033	< 2.2e-16	***
Site2:BB2	3099.2	64.441	252	48.0926	< 2.2e-16	***
Site2:BB3	2577.7	64.441	252	39.9999	< 2.2e-16	***
Site2:BB4	2111.0	64.441	252	32.7585	< 2.2e-16	***
Site2:BB5	1589.0	64.441	252	24.6581	< 2.2e-16	***
Site2:BB6	1116.0	64.441	252	17.3173	< 2.2e-16	***
Site2:BB7	555.1	64.441	252	8.6133	8.882e-16	***
Site2:BB8	0.0	0.000	252			
Site3:BB1	0.0	0.000	252			
Site3:BB2	0.0	0.000	252			
Site3:BB3	0.0	0.000	252			
Site3:BB4	0.0	0.000	252			
Site3:BB5	0.0	0.000	252			
Site3:BB6	0.0	0.000	252			

Site3:BB7	0.0	0.000	252			
Site3:BB8	0.0	0.000	252			
Site1:BlockR1:BB1	-1733.0	45.567	252	-38.0320	< 2.2e-16	***
Site1:BlockR1:BB2	-1498.6	45.567	252	-32.8879	< 2.2e-16	***
Site1:BlockR1:BB3	-1281.4	45.567	252	-28.1213	< 2.2e-16	***
Site1:BlockR1:BB4	-984.4	45.567	252	-21.6034	< 2.2e-16	***
Site1:BlockR1:BB5	-743.6	45.567	252	-16.3189	< 2.2e-16	***
Site1:BlockR1:BB6	-499.4	45.567	252	-10.9597	< 2.2e-16	***
Site1:BlockR1:BB7	-196.2	45.567	252	-4.3058	2.385e-05	***
Site1:BlockR1:BB8	0.0	0.000	252			
Site1:BlockR2:BB1	-1721.2	45.567	252	-37.7730	< 2.2e-16	***
Site1:BlockR2:BB2	-1606.0	45.567	252	-35.2449	< 2.2e-16	***
Site1:BlockR2:BB3	-1267.6	45.567	252	-27.8184	< 2.2e-16	***
Site1:BlockR2:BB4	-1005.4	45.567	252	-22.0642	< 2.2e-16	***
Site1:BlockR2:BB5	-800.4	45.567	252	-17.5654	< 2.2e-16	***
Site1:BlockR2:BB6	-486.4	45.567	252	-10.6744	< 2.2e-16	***
Site1:BlockR2:BB7	-233.8	45.567	252	-5.1309	5.761e-07	***
Site1:BlockR2:BB8	0.0	0.000	252			
Site1:BlockR3:BB1	-1709.0	45.567	252	-37.5053	< 2.2e-16	***
Site1:BlockR3:BB2	-1522.6	45.567	252	-33.4146	< 2.2e-16	***
Site1:BlockR3:BB3	-1220.2	45.567	252	-26.7782	< 2.2e-16	***
Site1:BlockR3:BB4	-965.2	45.567	252	-21.1820	< 2.2e-16	***
Site1:BlockR3:BB5	-767.8	45.567	252	-16.8499	< 2.2e-16	***
Site1:BlockR3:BB6	-476.2	45.567	252	-10.4506	< 2.2e-16	***
Site1:BlockR3:BB7	-220.2	45.567	252	-4.8325	2.345e-06	***
Site1:BlockR3:BB8	0.0	0.000	252			
Site1:BlockR4:BB1	0.0	0.000	252			
Site1:BlockR4:BB2	0.0	0.000	252			
Site1:BlockR4:BB3	0.0	0.000	252			
Site1:BlockR4:BB4	0.0	0.000	252			
Site1:BlockR4:BB5	0.0	0.000	252			
Site1:BlockR4:BB6	0.0	0.000	252			
Site1:BlockR4:BB7	0.0	0.000	252			
Site1:BlockR4:BB8	0.0	0.000	252			
Site2:BlockR1:BB1	-3519.6	45.567	252	-77.2402	< 2.2e-16	***
Site2:BlockR1:BB2	-3097.8	45.567	252	-67.9835	< 2.2e-16	***
Site2:BlockR1:BB3	-2563.0	45.567	252	-56.2469	< 2.2e-16	***
Site2:BlockR1:BB4	-2044.0	45.567	252	-44.8571	< 2.2e-16	***
Site2:BlockR1:BB5	-1539.6	45.567	252	-33.7877	< 2.2e-16	***
Site2:BlockR1:BB6	-1052.8	45.567	252	-23.1045	< 2.2e-16	***
Site2:BlockR1:BB7	-552.0	45.567	252	-12.1141	< 2.2e-16	***
Site2:BlockR1:BB8	0.0	0.000	252			
Site2:BlockR2:BB1	-5360.8	45.567	252	-117.6467	< 2.2e-16	***
Site2:BlockR2:BB2	-4648.0	45.567	252	-102.0038	< 2.2e-16	***
Site2:BlockR2:BB3	-3890.2	45.567	252	-85.3733	< 2.2e-16	***
Site2:BlockR2:BB4	-3094.2	45.567	252	-67.9045	< 2.2e-16	***
Site2:BlockR2:BB5	-2335.6	45.567	252	-51.2565	< 2.2e-16	***
Site2:BlockR2:BB6	-1556.2	45.567	252	-34.1520	< 2.2e-16	***

Site2:BlockR2:BB7	-830.8	45.567	252	-18.2325	< 2.2e-16	***
Site2:BlockR2:BB8	0.0	0.000	252			
Site2:BlockR3:BB1	-5309.4	45.567	252	-116.5187	< 2.2e-16	***
Site2:BlockR3:BB2	-4604.2	45.567	252	-101.0426	< 2.2e-16	***
Site2:BlockR3:BB3	-3827.2	45.567	252	-83.9907	< 2.2e-16	***
Site2:BlockR3:BB4	-3058.2	45.567	252	-67.1145	< 2.2e-16	***
Site2:BlockR3:BB5	-2281.6	45.567	252	-50.0714	< 2.2e-16	***
Site2:BlockR3:BB6	-1466.6	45.567	252	-32.1856	< 2.2e-16	***
Site2:BlockR3:BB7	-795.8	45.567	252	-17.4644	< 2.2e-16	***
Site2:BlockR3:BB8	0.0	0.000	252			
Site2:BlockR4:BB1	0.0	0.000	252			
Site2:BlockR4:BB2	0.0	0.000	252			
Site2:BlockR4:BB3	0.0	0.000	252			
Site2:BlockR4:BB4	0.0	0.000	252			
Site2:BlockR4:BB5	0.0	0.000	252			
Site2:BlockR4:BB6	0.0	0.000	252			
Site2:BlockR4:BB7	0.0	0.000	252			
Site2:BlockR4:BB8	0.0	0.000	252			
Site3:BlockR1:BB1	-7.4	45.567	252	-0.1624	0.8711222	
Site3:BlockR1:BB2	26.4	45.567	252	0.5794	0.5628587	
Site3:BlockR1:BB3	-48.4	45.567	252	-1.0622	0.2891736	
Site3:BlockR1:BB4	-67.6	45.567	252	-1.4835	0.1391827	
Site3:BlockR1:BB5	-35.0	45.567	252	-0.7681	0.4431463	
Site3:BlockR1:BB6	-8.2	45.567	252	-0.1800	0.8573324	
Site3:BlockR1:BB7	-66.6	45.567	252	-1.4616	0.1451004	
Site3:BlockR1:BB8	0.0	0.000	252			
Site3:BlockR2:BB1	-1771.4	45.567	252	-38.8747	< 2.2e-16	***
Site3:BlockR2:BB2	-1533.8	45.567	252	-33.6604	< 2.2e-16	***
Site3:BlockR2:BB3	-1295.8	45.567	252	-28.4373	< 2.2e-16	***
Site3:BlockR2:BB4	-1082.6	45.567	252	-23.7585	< 2.2e-16	***
Site3:BlockR2:BB5	-796.0	45.567	252	-17.4688	< 2.2e-16	***
Site3:BlockR2:BB6	-482.0	45.567	252	-10.5778	< 2.2e-16	***
Site3:BlockR2:BB7	-304.2	45.567	252	-6.6759	1.556e-10	***
Site3:BlockR2:BB8	0.0	0.000	252			
Site3:BlockR3:BB1	-1772.4	45.567	252	-38.8966	< 2.2e-16	***
Site3:BlockR3:BB2	-1509.0	45.567	252	-33.1161	< 2.2e-16	***
Site3:BlockR3:BB3	-1281.6	45.567	252	-28.1257	< 2.2e-16	***
Site3:BlockR3:BB4	-1013.2	45.567	252	-22.2354	< 2.2e-16	***
Site3:BlockR3:BB5	-751.8	45.567	252	-16.4988	< 2.2e-16	***
Site3:BlockR3:BB6	-462.6	45.567	252	-10.1521	< 2.2e-16	***
Site3:BlockR3:BB7	-248.6	45.567	252	-5.4557	1.165e-07	***
Site3:BlockR3:BB8	0.0	0.000	252			
Site3:BlockR4:BB1	0.0	0.000	252			
Site3:BlockR4:BB2	0.0	0.000	252			
Site3:BlockR4:BB3	0.0	0.000	252			
Site3:BlockR4:BB4	0.0	0.000	252			
Site3:BlockR4:BB5	0.0	0.000	252			
Site3:BlockR4:BB6	0.0	0.000	252			

Site3:BlockR4:BB7	0.0	0.000	252		
Site3:BlockR4:BB8	0.0	0.000	252		
AA1:BB1	-61.5	50.945	252	-1.2072	0.2284965
AA1:BB2	-140.0	50.945	252	-2.7480	0.0064285 **
AA1:BB3	-57.7	50.945	252	-1.1336	0.2580534
AA1:BB4	-29.2	50.945	252	-0.5741	0.5663822
AA1:BB5	-66.7	50.945	252	-1.3102	0.1913120
AA1:BB6	-41.5	50.945	252	-0.8146	0.4160716
AA1:BB7	-40.5	50.945	252	-0.7950	0.4273795
AA1:BB8	0.0	0.000	252		
AA2:BB1	-32.5	50.945	252	-0.6379	0.5240931
AA2:BB2	-62.7	50.945	252	-1.2317	0.2192050
AA2:BB3	-59.0	50.945	252	-1.1581	0.2479183
AA2:BB4	51.8	50.945	252	1.0158	0.3107018
AA2:BB5	3.8	50.945	252	0.0736	0.9413805
AA2:BB6	8.3	50.945	252	0.1619	0.8714843
AA2:BB7	6.3	50.945	252	0.1227	0.9024579
AA2:BB8	0.0	0.000	252		
AA3:BB1	-90.0	50.945	252	-1.7666	0.0785061 .
AA3:BB2	-122.7	50.945	252	-2.4094	0.0166946 *
AA3:BB3	-110.0	50.945	252	-2.1592	0.0317805 *
AA3:BB4	-63.0	50.945	252	-1.2366	0.2173799
AA3:BB5	-36.7	50.945	252	-0.7214	0.4713562
AA3:BB6	-11.5	50.945	252	-0.2257	0.8215928
AA3:BB7	-104.2	50.945	252	-2.0463	0.0417637 *
AA3:BB8	0.0	0.000	252		
AA4:BB1	-66.2	50.945	252	-1.3004	0.1946476
AA4:BB2	-60.2	50.945	252	-1.1826	0.2380667
AA4:BB3	-7.5	50.945	252	-0.1472	0.8830788
AA4:BB4	3.8	50.945	252	0.0736	0.9413805
AA4:BB5	12.0	50.945	252	0.2355	0.8139760
AA4:BB6	14.5	50.945	252	0.2846	0.7761701
AA4:BB7	-37.2	50.945	252	-0.7312	0.4653514
AA4:BB8	0.0	0.000	252		
AA5:BB1	0.0	0.000	252		
AA5:BB2	0.0	0.000	252		
AA5:BB3	0.0	0.000	252		
AA5:BB4	0.0	0.000	252		
AA5:BB5	0.0	0.000	252		
AA5:BB6	0.0	0.000	252		
AA5:BB7	0.0	0.000	252		
AA5:BB8	0.0	0.000	252		
Site1:AA1:BB1	67.2	72.048	252	0.9334	0.3515017
Site1:AA1:BB2	118.7	72.048	252	1.6482	0.1005547
Site1:AA1:BB3	49.7	72.048	252	0.6905	0.4905056
Site1:AA1:BB4	-13.0	72.048	252	-0.1804	0.8569552
Site1:AA1:BB5	77.7	72.048	252	1.0791	0.2815539
Site1:AA1:BB6	10.5	72.048	252	0.1457	0.8842456

Site1:AA1:BB7	48.7	72.048	252	0.6766	0.4992577	
Site1:AA1:BB8	0.0	0.000	252			
Site1:AA2:BB1	47.5	72.048	252	0.6593	0.5103141	
Site1:AA2:BB2	75.5	72.048	252	1.0479	0.2956805	
Site1:AA2:BB3	35.2	72.048	252	0.4893	0.6250835	
Site1:AA2:BB4	-56.8	72.048	252	-0.7877	0.4316280	
Site1:AA2:BB5	-52.5	72.048	252	-0.7287	0.4668712	
Site1:AA2:BB6	-57.3	72.048	252	-0.7946	0.4275862	
Site1:AA2:BB7	-7.0	72.048	252	-0.0972	0.9226782	
Site1:AA2:BB8	0.0	0.000	252			
Site1:AA3:BB1	172.0	72.048	252	2.3873	0.0177101	*
Site1:AA3:BB2	116.0	72.048	252	1.6100	0.1086397	
Site1:AA3:BB3	123.2	72.048	252	1.7107	0.0883720	.
Site1:AA3:BB4	21.0	72.048	252	0.2915	0.7709287	
Site1:AA3:BB5	64.7	72.048	252	0.8987	0.3696645	
Site1:AA3:BB6	-24.3	72.048	252	-0.3366	0.7367115	
Site1:AA3:BB7	182.7	72.048	252	2.5365	0.0118006	*
Site1:AA3:BB8	0.0	0.000	252			
Site1:AA4:BB1	104.5	72.048	252	1.4504	0.1481824	
Site1:AA4:BB2	95.7	72.048	252	1.3290	0.1850560	
Site1:AA4:BB3	73.2	72.048	252	1.0167	0.3102767	
Site1:AA4:BB4	9.7	72.048	252	0.1353	0.8924613	
Site1:AA4:BB5	-17.3	72.048	252	-0.2394	0.8109707	
Site1:AA4:BB6	-30.5	72.048	252	-0.4233	0.6724148	
Site1:AA4:BB7	141.7	72.048	252	1.9674	0.0502283	.
Site1:AA4:BB8	0.0	0.000	252			
Site1:AA5:BB1	0.0	0.000	252			
Site1:AA5:BB2	0.0	0.000	252			
Site1:AA5:BB3	0.0	0.000	252			
Site1:AA5:BB4	0.0	0.000	252			
Site1:AA5:BB5	0.0	0.000	252			
Site1:AA5:BB6	0.0	0.000	252			
Site1:AA5:BB7	0.0	0.000	252			
Site1:AA5:BB8	0.0	0.000	252			
Site2:AA1:BB1	-11.8	72.048	252	-0.1631	0.8705810	
Site2:AA1:BB2	106.7	72.048	252	1.4817	0.1396805	
Site2:AA1:BB3	8.7	72.048	252	0.1214	0.9034334	
Site2:AA1:BB4	-57.5	72.048	252	-0.7981	0.4255737	
Site2:AA1:BB5	17.5	72.048	252	0.2429	0.8082844	
Site2:AA1:BB6	-26.3	72.048	252	-0.3643	0.7159080	
Site2:AA1:BB7	-30.0	72.048	252	-0.4164	0.6774782	
Site2:AA1:BB8	0.0	0.000	252			
Site2:AA2:BB1	-89.5	72.048	252	-1.2422	0.2153051	
Site2:AA2:BB2	-74.3	72.048	252	-1.0306	0.3037314	
Site2:AA2:BB3	-32.3	72.048	252	-0.4476	0.6548116	
Site2:AA2:BB4	-151.8	72.048	252	-2.1062	0.0361722	*
Site2:AA2:BB5	-127.5	72.048	252	-1.7697	0.0779927	.
Site2:AA2:BB6	-163.5	72.048	252	-2.2693	0.0240938	*

Site2:AA2:BB7	-127.5	72.048	252	-1.7697	0.0779927	.
Site2:AA2:BB8	0.0	0.000	252			
Site2:AA3:BB1	57.7	72.048	252	0.8016	0.4235667	
Site2:AA3:BB2	82.0	72.048	252	1.1381	0.2561446	
Site2:AA3:BB3	95.2	72.048	252	1.3220	0.1873529	
Site2:AA3:BB4	-32.0	72.048	252	-0.4442	0.6573149	
Site2:AA3:BB5	60.2	72.048	252	0.8363	0.4038052	
Site2:AA3:BB6	-45.0	72.048	252	-0.6246	0.5328074	
Site2:AA3:BB7	69.7	72.048	252	0.9681	0.3339179	
Site2:AA3:BB8	0.0	0.000	252			
Site2:AA4:BB1	-22.3	72.048	252	-0.3088	0.7577110	
Site2:AA4:BB2	-49.3	72.048	252	-0.6836	0.4948713	
Site2:AA4:BB3	-4.0	72.048	252	-0.0555	0.9557691	
Site2:AA4:BB4	-57.8	72.048	252	-0.8016	0.4235667	
Site2:AA4:BB5	-81.3	72.048	252	-1.1277	0.2605082	
Site2:AA4:BB6	-111.0	72.048	252	-1.5406	0.1246574	
Site2:AA4:BB7	-65.5	72.048	252	-0.9091	0.3641550	
Site2:AA4:BB8	0.0	0.000	252			
Site2:AA5:BB1	0.0	0.000	252			
Site2:AA5:BB2	0.0	0.000	252			
Site2:AA5:BB3	0.0	0.000	252			
Site2:AA5:BB4	0.0	0.000	252			
Site2:AA5:BB5	0.0	0.000	252			
Site2:AA5:BB6	0.0	0.000	252			
Site2:AA5:BB7	0.0	0.000	252			
Site2:AA5:BB8	0.0	0.000	252			
Site3:AA1:BB1	0.0	0.000	252			
Site3:AA1:BB2	0.0	0.000	252			
Site3:AA1:BB3	0.0	0.000	252			
Site3:AA1:BB4	0.0	0.000	252			
Site3:AA1:BB5	0.0	0.000	252			
Site3:AA1:BB6	0.0	0.000	252			
Site3:AA1:BB7	0.0	0.000	252			
Site3:AA1:BB8	0.0	0.000	252			
Site3:AA2:BB1	0.0	0.000	252			
Site3:AA2:BB2	0.0	0.000	252			
Site3:AA2:BB3	0.0	0.000	252			
Site3:AA2:BB4	0.0	0.000	252			
Site3:AA2:BB5	0.0	0.000	252			
Site3:AA2:BB6	0.0	0.000	252			
Site3:AA2:BB7	0.0	0.000	252			
Site3:AA2:BB8	0.0	0.000	252			
Site3:AA3:BB1	0.0	0.000	252			
Site3:AA3:BB2	0.0	0.000	252			
Site3:AA3:BB3	0.0	0.000	252			
Site3:AA3:BB4	0.0	0.000	252			
Site3:AA3:BB5	0.0	0.000	252			
Site3:AA3:BB6	0.0	0.000	252			

Site3:AA3:BB7	0.0	0.000	252
Site3:AA3:BB8	0.0	0.000	252
Site3:AA4:BB1	0.0	0.000	252
Site3:AA4:BB2	0.0	0.000	252
Site3:AA4:BB3	0.0	0.000	252
Site3:AA4:BB4	0.0	0.000	252
Site3:AA4:BB5	0.0	0.000	252
Site3:AA4:BB6	0.0	0.000	252
Site3:AA4:BB7	0.0	0.000	252
Site3:AA4:BB8	0.0	0.000	252
Site3:AA5:BB1	0.0	0.000	252
Site3:AA5:BB2	0.0	0.000	252
Site3:AA5:BB3	0.0	0.000	252
Site3:AA5:BB4	0.0	0.000	252
Site3:AA5:BB5	0.0	0.000	252
Site3:AA5:BB6	0.0	0.000	252
Site3:AA5:BB7	0.0	0.000	252
Site3:AA5:BB8	0.0	0.000	252

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

7.16 Example 11.1

(92) MODEL

```
ex11.1 = read.table("C:/G/Rt/Split/Ex11.1-cov.txt", header=TRUE)
ex11.1 = af(ex11.1, c("R", "T", "S"))
GLM(Y ~ R + T + R:T + S + S:T, ex11.1)
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	11	328	29.8182	3.1948	0.02875 *
RESIDUALS	12	112	9.3333		
CORRECTED TOTAL	23	440			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	48	24	2.5714	0.11765
T	1	24	24	2.5714	0.13479
R:T	2	16	8	0.8571	0.44880
S	3	156	52	5.5714	0.01251 *
T:S	3	84	28	3.0000	0.07277 .

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	48	24	2.5714	0.11765
T	1	24	24	2.5714	0.13479
R:T	2	16	8	0.8571	0.44880
S	3	156	52	5.5714	0.01251 *
T:S	3	84	28	3.0000	0.07277 .

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	48	24	2.5714	0.11765
T	1	24	24	2.5714	0.13479
R:T	2	16	8	0.8571	0.44880
S	3	156	52	5.5714	0.01251 *
T:S	3	84	28	3.0000	0.07277 .

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	17	2.1602	12	7.8695	4.448e-06 ***
R1	-5	2.1602	12	-2.3146	0.0391521 *
R2	-1	2.1602	12	-0.4629	0.6517110
R3	0	0.0000	12		
T1	-10	3.0551	12	-3.2733	0.0066627 **
T2	0	0.0000	12		
R1:T1	4	3.0551	12	1.3093	0.2149461
R1:T2	0	0.0000	12		
R2:T1	2	3.0551	12	0.6547	0.5250404
R2:T2	0	0.0000	12		
R3:T1	0	0.0000	12		
R3:T2	0	0.0000	12		
S1	-8	2.4944	12	-3.2071	0.0075321 **
S2	-9	2.4944	12	-3.6080	0.0035926 **
S3	-11	2.4944	12	-4.4098	0.0008506 ***
S4	0	0.0000	12		
T1:S1	6	3.5277	12	1.7008	0.1147185
T1:S2	10	3.5277	12	2.8347	0.0150430 *
T1:S3	8	3.5277	12	2.2678	0.0426079 *
T1:S4	0	0.0000	12		
T2:S1	0	0.0000	12		
T2:S2	0	0.0000	12		
T2:S3	0	0.0000	12		
T2:S4	0	0.0000	12		

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

(93) MODEL

```
GLM(Z ~ R + T + R:T + S + S:T, ex11.1)
```

\$ANOVA

Response : Z

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	11	46	4.1818	2.5091	0.06452 .
RESIDUALS	12	20	1.6667		
CORRECTED TOTAL	23	66			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	9	4.5	2.7	0.1076
T	1	6	6.0	3.6	0.0821 .
R:T	2	1	0.5	0.3	0.7462
S	3	9	3.0	1.8	0.2008
T:S	3	21	7.0	4.2	0.0301 *

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	9	4.5	2.7	0.1076
T	1	6	6.0	3.6	0.0821 .
R:T	2	1	0.5	0.3	0.7462
S	3	9	3.0	1.8	0.2008
T:S	3	21	7.0	4.2	0.0301 *

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	9	4.5	2.7	0.1076
T	1	6	6.0	3.6	0.0821 .
R:T	2	1	0.5	0.3	0.7462
S	3	9	3.0	1.8	0.2008
T:S	3	21	7.0	4.2	0.0301 *

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	6.0	0.91287	12	6.5727	2.641e-05 ***
R1	-2.0	0.91287	12	-2.1909	0.048930 *
R2	-1.0	0.91287	12	-1.0954	0.294821
R3	0.0	0.00000	12		
T1	-3.5	1.29099	12	-2.7111	0.018917 *
T2	0.0	0.00000	12		
R1:T1	1.0	1.29099	12	0.7746	0.453571
R1:T2	0.0	0.00000	12		
R2:T1	0.5	1.29099	12	0.3873	0.705317
R2:T2	0.0	0.00000	12		
R3:T1	0.0	0.00000	12		
R3:T2	0.0	0.00000	12		
S1	-2.0	1.05409	12	-1.8974	0.082097 .
S2	-4.0	1.05409	12	-3.7947	0.002554 **
S3	-2.0	1.05409	12	-1.8974	0.082097 .
S4	0.0	0.00000	12		
T1:S1	2.0	1.49071	12	1.3416	0.204550
T1:S2	5.0	1.49071	12	3.3541	0.005736 **
T1:S3	1.0	1.49071	12	0.6708	0.515039
T1:S4	0.0	0.00000	12		
T2:S1	0.0	0.00000	12		
T2:S2	0.0	0.00000	12		
T2:S3	0.0	0.00000	12		
T2:S4	0.0	0.00000	12		

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

(94) MODEL

```
GLM(Y ~ R + T + R:T + S + S:T + Z, ex11.1)
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	12	342.45	28.5375	3.218	0.03116 *
RESIDUALS	11	97.55	8.8682		
CORRECTED TOTAL	23	440.00			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	48.00	24.00	2.7063	0.11071
T	1	24.00	24.00	2.7063	0.12820
R:T	2	16.00	8.00	0.9021	0.43373
S	3	156.00	52.00	5.8637	0.01211 *

```
T:S  3  84.00   28.00   3.1574 0.06828 .
Z    1  14.45   14.45   1.6294 0.22807
```

```
---
```

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

```
$`Type II`
```

```
      Df Sum Sq Mean Sq F value Pr(>F)
R      2 18.300   9.1500   1.0318 0.38844
T      1  2.679   2.6786   0.3020 0.59359
R:T    2  9.450   4.7250   0.5328 0.60137
S      3 79.196  26.3985   2.9768 0.07822 .
T:S    3 37.474  12.4915   1.4086 0.29234
Z      1 14.450  14.4500   1.6294 0.22807
```

```
---
```

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

```
$`Type III`
```

```
      Df Sum Sq Mean Sq F value Pr(>F)
R      2 20.209  10.1043   1.1394 0.35505
T      1  6.104   6.1038   0.6883 0.42439
R:T    2  9.450   4.7250   0.5328 0.60137
S      3 84.243  28.0810   3.1665 0.06782 .
T:S    3 37.474  12.4915   1.4086 0.29234
Z      1 14.450  14.4500   1.6294 0.22807
```

```
---
```

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

```
$Parameter
```

```
      Estimate Std. Error Df t value Pr(>|t|)
(Intercept)  11.900      4.5163 11  2.6349 0.023203 *
R1            -3.300      2.4915 11 -1.3245 0.212200
R2            -0.150      2.2085 11 -0.0679 0.947069
R3             0.000      0.0000 11
T1            -7.025      3.7815 11 -1.8577 0.090160 .
T2             0.000      0.0000 11
R1:T1          3.150      3.0515 11  1.0323 0.324102
R1:T2          0.000      0.0000 11
R2:T1          1.575      2.9965 11  0.5256 0.609590
R2:T2          0.000      0.0000 11
R3:T1          0.000      0.0000 11
R3:T2          0.000      0.0000 11
S1            -6.300      2.7723 11 -2.2725 0.044116 *
S2            -5.600      3.6065 11 -1.5528 0.148760
S3            -9.300      2.7723 11 -3.3546 0.006425 **
S4             0.000      0.0000 11
T1:S1          4.300      3.6875 11  1.1661 0.268238
T1:S2          5.750      4.7864 11  1.2013 0.254853
T1:S3          7.150      3.5025 11  2.0414 0.065946 .
```

```

T1:S4      0.000      0.0000 11
T2:S1      0.000      0.0000 11
T2:S2      0.000      0.0000 11
T2:S3      0.000      0.0000 11
T2:S4      0.000      0.0000 11
Z          0.850      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

```

ex11.2a = read.table("C:/G/Rt/Split/Ex11.2-sp3.txt", header=TRUE)
ex11.2a = af(ex11.2a, "A")
ex11.2a$MY = (ex11.2a$Y1 + ex11.2a$Y2)/sqrt(2)
ex11.2a$Z = 2*ex11.2a$Z/sqrt(2)
GLM(MY ~ Z + A, ex11.2a)

```

\$ANOVA

Response : MY

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	2	234.639	117.32	9.5696	0.01953 *
RESIDUALS	5	61.298	12.26		
CORRECTED TOTAL	7	295.937			

```

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

```

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Z	1	190.148	190.148	15.5101	0.01098 *
A	1	44.492	44.492	3.6291	0.11512

```

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

```

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Z	1	166.577	166.577	13.5874	0.0142 *
A	1	44.492	44.492	3.6291	0.1151

```

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

```

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Z	1	166.577	166.577	13.5874	0.0142 *
A	1	44.492	44.492	3.6291	0.1151

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

```
$Parameter
      Estimate Std. Error Df t value Pr(>|t|)
(Intercept) 15.3934     2.70222  5  5.6966 0.002326 **
Z            1.0219     0.27724  5  3.6861 0.014203 *
A1          -4.7497     2.49325  5 -1.9050 0.115119
A2           0.0000     0.00000  5
```

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

(96) MODEL

```
ex11.2b = read.table("C:/G/Rt/Split/Ex11.2-two.txt", header=TRUE)
ex11.2b = af(ex11.2b, c("sub", "A", "B"))
GLM(Y ~ A + A:sub + B + A:B, ex11.2b)
```

```
$ANOVA
Response : Y
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      9 382.06   42.451   39.954 0.0001135 ***
RESIDUALS    6   6.38    1.062
CORRECTED TOTAL 15 388.44
```

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

```
$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
A       1  68.062   68.062  64.0588 0.0002029 ***
A:sub    6 227.875   37.979  35.7451 0.0001934 ***
B       1  85.562   85.562  80.5294 0.0001070 ***
A:B      1   0.562    0.562   0.5294 0.4942562
```

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

```
$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
A       1  68.062   68.062  64.0588 0.0002029 ***
A:sub    6 227.875   37.979  35.7451 0.0001934 ***
B       1  85.562   85.562  80.5294 0.0001070 ***
A:B      1   0.562    0.562   0.5294 0.4942562
```

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

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

```

A      1  68.062  68.062 64.0588 0.0002029 ***
A:sub  6 227.875  37.979 35.7451 0.0001934 ***
B      1  85.562  85.562 80.5294 0.0001070 ***
A:B    1   0.562   0.562  0.5294 0.4942562
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$Parameter
      Estimate Std. Error Df t value Pr(>|t|)
(Intercept)  10.000     0.81490 6 12.2714 1.784e-05 ***
A1           -3.125     1.15244 6 -2.7116 0.0350301 *
A2            0.000     0.00000 6
A1:sub1       0.000     1.03078 6  0.0000 1.0000000
A1:sub2       4.500     1.03078 6  4.3656 0.0047414 **
A1:sub3       8.000     1.03078 6  7.7611 0.0002406 ***
A1:sub4       0.000     0.00000 6
A1:sub5
A1:sub6
A1:sub7
A1:sub8
A2:sub1
A2:sub2
A2:sub3
A2:sub4
A2:sub5       0.000     1.03078 6  0.0000 1.0000000
A2:sub6      10.000     1.03078 6  9.7014 6.883e-05 ***
A2:sub7       5.000     1.03078 6  4.8507 0.0028496 **
A2:sub8       0.000     0.00000 6
B1            5.000     0.72887 6  6.8599 0.0004725 ***
B2            0.000     0.00000 6
A1:B1       -0.750     1.03078 6 -0.7276 0.4942562
A1:B2        0.000     0.00000 6
A2:B1        0.000     0.00000 6
A2:B2        0.000     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	Std. Error	Df	t value	Pr(> t)
(Intercept)	17	2.1602	12	7.8695	4.448e-06 ***
block1	-5	2.1602	12	-2.3146	0.0391521 *
block2	-1	2.1602	12	-0.4629	0.6517110
block3	0	0.0000	12		
whole1	-10	3.0551	12	-3.2733	0.0066627 **
whole2	0	0.0000	12		
block1:whole1	4	3.0551	12	1.3093	0.2149461
block1:whole2	0	0.0000	12		
block2:whole1	2	3.0551	12	0.6547	0.5250404
block2:whole2	0	0.0000	12		
block3:whole1	0	0.0000	12		

```

block3:whole2      0      0.0000 12
split1             -8      2.4944 12 -3.2071 0.0075321 **
split2             -9      2.4944 12 -3.6080 0.0035926 **
split3            -11      2.4944 12 -4.4098 0.0008506 ***
split4              0      0.0000 12
whole1:split1       6      3.5277 12  1.7008 0.1147185
whole1:split2      10      3.5277 12  2.8347 0.0150430 *
whole1:split3       8      3.5277 12  2.2678 0.0426079 *
whole1:split4       0      0.0000 12
whole2:split1       0      0.0000 12
whole2:split2       0      0.0000 12
whole2:split3       0      0.0000 12
whole2:split4       0      0.0000 12

```

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

(98) MODEL

```
GLM(Z ~ block + whole + block:whole + split + split:whole, ex11.2c)
```

\$ANOVA

Response : Z

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	11	38	3.4545	3.5903e+15	< 2.2e-16 ***
RESIDUALS	12	0	0.0000		
CORRECTED TOTAL	23	38			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	36.000	18.0000	1.8707e+16	<2e-16 ***
whole	1	0.667	0.6667	6.9286e+14	<2e-16 ***
block:whole	2	1.333	0.6667	6.9286e+14	<2e-16 ***
split	3	0.000	0.0000	0.0000e+00	1
whole:split	3	0.000	0.0000	0.0000e+00	1

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	36.000	18.0000	1.8707e+16	<2e-16 ***
whole	1	0.667	0.6667	6.9286e+14	<2e-16 ***
block:whole	2	1.333	0.6667	6.9286e+14	<2e-16 ***
split	3	0.000	0.0000	0.0000e+00	1
whole:split	3	0.000	0.0000	0.0000e+00	1

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	36.000	18.0000	1.8707e+16	<2e-16 ***
whole	1	0.667	0.6667	6.9286e+14	<2e-16 ***
block:whole	2	1.333	0.6667	6.9286e+14	<2e-16 ***
split	3	0.000	0.0000	0.0000e+00	1
whole:split	3	0.000	0.0000	0.0000e+00	1

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	5	2.1934e-08	12	227957476	<2e-16 ***
block1	-3	2.1934e-08	12	-136774486	<2e-16 ***
block2	-1	2.1934e-08	12	-45591495	<2e-16 ***
block3	0	0.0000e+00	12		
whole1	0	3.1019e-08	12	0	1
whole2	0	0.0000e+00	12		
block1:whole1	0	3.1019e-08	12	0	1
block1:whole2	0	0.0000e+00	12		
block2:whole1	-1	3.1019e-08	12	-32238055	<2e-16 ***
block2:whole2	0	0.0000e+00	12		
block3:whole1	0	0.0000e+00	12		
block3:whole2	0	0.0000e+00	12		
split1	0	2.5327e-08	12	0	1
split2	0	2.5327e-08	12	0	1
split3	0	2.5327e-08	12	0	1
split4	0	0.0000e+00	12		
whole1:split1	0	3.5818e-08	12	0	1
whole1:split2	0	3.5818e-08	12	0	1
whole1:split3	0	3.5818e-08	12	0	1
whole1:split4	0	0.0000e+00	12		
whole2:split1	0	0.0000e+00	12		
whole2:split2	0	0.0000e+00	12		
whole2:split3	0	0.0000e+00	12		
whole2:split4	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	Std. Error	Df	t value	Pr(> t)
(Intercept)	17	2.1602	12	7.8695	4.448e-06 ***
block1	-5	2.1602	12	-2.3146	0.0391521 *
block2	-1	2.1602	12	-0.4629	0.6517110
block3	0	0.0000	12		
whole1	-10	3.0551	12	-3.2733	0.0066627 **

```

whole2          0      0.0000 12
block1:whole1   4      3.0551 12  1.3093 0.2149461
block1:whole2   0      0.0000 12
block2:whole1   2      3.0551 12  0.6547 0.5250404
block2:whole2   0      0.0000 12
block3:whole1   0      0.0000 12
block3:whole2   0      0.0000 12
split1         -8      2.4944 12 -3.2071 0.0075321 **
split2         -9      2.4944 12 -3.6080 0.0035926 **
split3        -11      2.4944 12 -4.4098 0.0008506 ***
split4          0      0.0000 12
whole1:split1    6      3.5277 12  1.7008 0.1147185
whole1:split2   10      3.5277 12  2.8347 0.0150430 *
whole1:split3    8      3.5277 12  2.2678 0.0426079 *
whole1:split4    0      0.0000 12
whole2:split1    0      0.0000 12
whole2:split2    0      0.0000 12
whole2:split3    0      0.0000 12
whole2:split4    0      0.0000 12
Z               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	Std. Error	Df	t value	Pr(> t)
(Intercept)	4.5000	0.61237	6	7.3485	0.000325 ***
block1	-1.3333	0.81650	6	-1.6330	0.153590
block2	-0.3333	0.81650	6	-0.4082	0.697261
block3	-0.3333	0.81650	6	-0.4082	0.697261
block4	0.0000	0.00000	6		
A1	-1.0000	0.70711	6	-1.4142	0.207031
A2	0.0000	0.00000	6		
block1:A1	0.6667	0.81650	6	0.8165	0.445416
block1:A2	0.0000	0.00000	6		
block2:A1	0.6667	0.81650	6	0.8165	0.445416
block2:A2	0.0000	0.00000	6		
block3:A1	0.6667	0.81650	6	0.8165	0.445416
block3:A2	0.0000	0.00000	6		
block4:A1	0.0000	0.00000	6		
block4:A2	0.0000	0.00000	6		
B1	-0.7500	0.79057	6	-0.9487	0.379410
B2	-1.7500	0.79057	6	-2.2136	0.068802 .
B3	0.0000	0.00000	6		
block1:B1	-0.5000	1.00000	6	-0.5000	0.634880
block1:B2	0.5000	1.00000	6	0.5000	0.634880
block1:B3	0.0000	0.00000	6		

```

block2:B1      -0.5000      1.00000  6 -0.5000  0.634880
block2:B2       0.5000      1.00000  6  0.5000  0.634880
block2:B3       0.0000      0.00000  6
block3:B1       0.0000      1.00000  6  0.0000  1.000000
block3:B2       0.0000      1.00000  6  0.0000  1.000000
block3:B3       0.0000      0.00000  6
block4:B1       0.0000      0.00000  6
block4:B2       0.0000      0.00000  6
block4:B3       0.0000      0.00000  6
A1:B1          -0.5000      0.70711  6 -0.7071  0.506021
A1:B2           0.5000      0.70711  6  0.7071  0.506021
A1:B3           0.0000      0.00000  6
A2:B1           0.0000      0.00000  6
A2:B2           0.0000      0.00000  6
A2:B3           0.0000      0.00000  6

```

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

(101) MODEL

```
GLM(Z ~ block + A + block:A + B + block:B + A:B, ex11.3)
```

\$ANOVA

Response : Z

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	17	31.167	1.83333	3.3	0.07324 .
RESIDUALS	6	3.333	0.55556		
CORRECTED TOTAL	23	34.500			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	3	6.8333	2.2778	4.1	0.06689 .
A	1	6.0000	6.0000	10.8	0.01669 *
block:A	3	1.6667	0.5556	1.0	0.45472
B	2	13.0000	6.5000	11.7	0.00850 **
block:B	6	3.6667	0.6111	1.1	0.45542
A:B	2	0.0000	0.0000	0.0	1.00000

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	3	6.8333	2.2778	4.1	0.06689 .
A	1	6.0000	6.0000	10.8	0.01669 *
block:A	3	1.6667	0.5556	1.0	0.45472

B	2	13.0000	6.5000	11.7	0.00850	**
block:B	6	3.6667	0.6111	1.1	0.45542	
A:B	2	0.0000	0.0000	0.0	1.00000	

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	3	6.8333	2.2778	4.1	0.06689 .
A	1	6.0000	6.0000	10.8	0.01669 *
block:A	3	1.6667	0.5556	1.0	0.45472
B	2	13.0000	6.5000	11.7	0.00850 **
block:B	6	3.6667	0.6111	1.1	0.45542
A:B	2	0.0000	0.0000	0.0	1.00000

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

\$Parameter

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

block4:B3	0.00000	0.00000	6		
A1:B1	0.00000	0.74536	6	0.0000	1.000000
A1:B2	0.00000	0.74536	6	0.0000	1.000000
A1:B3	0.00000	0.00000	6		
A2:B1	0.00000	0.00000	6		
A2:B2	0.00000	0.00000	6		
A2:B3	0.00000	0.00000	6		

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

(102) MODEL

```
GLM(Y ~ block + A + block:A + B + block:B + A:B + Z, ex11.3)
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	18	17.8417	0.99120	2.4884	0.1589
RESIDUALS	5	1.9917	0.39833		
CORRECTED TOTAL	23	19.8333			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	3	4.5000	1.5000	3.7657	0.09378 .
A	1	1.5000	1.5000	3.7657	0.10999
block:A	3	0.5000	0.1667	0.4184	0.74788
B	2	8.3333	4.1667	10.4603	0.01634 *
block:B	6	1.0000	0.1667	0.4184	0.84059
A:B	2	1.0000	0.5000	1.2552	0.36163
Z	1	1.0083	1.0083	2.5314	0.17248

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	3	3.6203	1.20678	3.0296	0.1319
A	1	0.0000	0.00000	0.0000	1.0000
block:A	3	0.2583	0.08611	0.2162	0.8813
B	2	1.0317	0.51587	1.2951	0.3522
block:B	6	0.4210	0.07017	0.1762	0.9717
A:B	2	1.0000	0.50000	1.2552	0.3616
Z	1	1.0083	1.00833	2.5314	0.1725

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	3	3.6613	1.22045	3.0639	0.1297
A	1	0.0054	0.00536	0.0134	0.9122

```

block:A  3 0.2583 0.08611  0.2162 0.8813
B         2 0.7685 0.38427  0.9647 0.4423
block:B   6 0.4210 0.07017  0.1762 0.9717
A:B       2 1.0000 0.50000  1.2552 0.3616
Z         1 1.0083 1.00833  2.5314 0.1725

```

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	2.94167	1.12164	5	2.6227	0.04695 *
block1	-1.33333	0.72877	5	-1.8296	0.12684
block2	-1.34167	0.96580	5	-1.3892	0.22347
block3	-0.24167	0.73105	5	-0.3306	0.75437
block4	0.00000	0.00000	5		
A1	-0.08333	0.85456	5	-0.0975	0.92611
A2	0.00000	0.00000	5		
block1:A1	0.11667	0.80660	5	0.1446	0.89065
block1:A2	0.00000	0.00000	5		
block2:A1	0.48333	0.73783	5	0.6551	0.54135
block2:A2	0.00000	0.00000	5		
block3:A1	-0.06667	0.86230	5	-0.0773	0.94137
block3:A2	0.00000	0.00000	5		
block4:A1	0.00000	0.00000	5		
block4:A2	0.00000	0.00000	5		
B1	-0.47500	0.72649	5	-0.6538	0.54210
B2	-1.20000	0.78576	5	-1.5272	0.18725
B3	0.00000	0.00000	5		
block1:B1	0.60000	1.12901	5	0.5314	0.61787
block1:B2	0.50000	0.89256	5	0.5602	0.59952
block1:B3	0.00000	0.00000	5		
block2:B1	0.60000	1.12901	5	0.5314	0.61787
block2:B2	0.77500	0.90914	5	0.8525	0.43289
block2:B3	0.00000	0.00000	5		
block3:B1	0.55000	0.95717	5	0.5746	0.59044
block3:B2	0.27500	0.90914	5	0.3025	0.77446
block3:B3	0.00000	0.00000	5		
block4:B1	0.00000	0.00000	5		
block4:B2	0.00000	0.00000	5		
block4:B3	0.00000	0.00000	5		
A1:B1	-0.50000	0.63114	5	-0.7922	0.46414
A1:B2	0.50000	0.63114	5	0.7922	0.46414
A1:B3	0.00000	0.00000	5		
A2:B1	0.00000	0.00000	5		
A2:B2	0.00000	0.00000	5		
A2:B3	0.00000	0.00000	5		
Z	0.55000	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	Std. Error	Df	t value	Pr(> t)
--	----------	------------	----	---------	----------


```

(Intercept)    25.90    0.61400  5 42.1822 1.413e-07 ***
brand1         -1.05    0.86833  5 -1.2092  0.28063
brand2          2.30    0.86833  5  2.6488  0.04549 *
brand3         -2.75    0.86833  5 -3.1670  0.02490 *
brand4          3.20    0.86833  5  3.6852  0.01422 *
brand5          0.00    0.00000  5
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

8.1.2 p205

(104) MODEL

```

v1p205 = read.table("C:/G/Rt/Kemp/v1p205.txt", head=TRUE)
v1p205 = af(v1p205,c("brand", "car"))
GLM(miles ~ brand + car %in% brand, v1p205) # OK

```

\$ANOVA

Response : miles

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	9	140.05	15.561	80.21	1.017e-13 ***
RESIDUALS	20	3.88	0.194		
CORRECTED TOTAL	29	143.93			

```

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

```

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
brand	4	133.243	33.311	171.7053	3.553e-15 ***
brand:car	5	6.803	1.361	7.0137	0.0006214 ***

```

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

```

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
brand	4	133.243	33.311	171.7053	3.553e-15 ***
brand:car	5	6.803	1.361	7.0137	0.0006214 ***

```

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

```

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
brand	4	133.243	33.311	171.7053	3.553e-15 ***
brand:car	5	6.803	1.361	7.0137	0.0006214 ***

```

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

```

```

$Parameter
      Estimate Std. Error Df    t value    Pr(>|t|)
(Intercept)  25.9000    0.25430 20  101.8496 < 2.2e-16 ***
brand1       -2.0333    0.35963 20   -5.6540 1.559e-05 ***
brand2        2.2333    0.35963 20    6.2101 4.580e-06 ***
brand3       -2.3667    0.35963 20   -6.5808 2.068e-06 ***
brand4        2.9333    0.35963 20    8.1565 8.629e-08 ***
brand5        0.0000    0.00000 20
brand1:car1    1.9333    0.35963 20    5.3759 2.915e-05 ***
brand1:car2    0.0000    0.00000 20
brand2:car1    0.1667    0.35963 20    0.4634  0.64805
brand2:car2    0.0000    0.00000 20
brand3:car1   -0.8667    0.35963 20   -2.4099  0.02571 *
brand3:car2    0.0000    0.00000 20
brand4:car1   -0.1333    0.35963 20   -0.3708  0.71472
brand4:car2    0.0000    0.00000 20
brand5:car1    0.0333    0.35963 20    0.0927  0.92707
brand5:car2    0.0000    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

```

v1p232 = read.table("C:/G/Rt/Kemp/v1p232.txt", head=TRUE)
v1p232 = af(v1p232,c("trt"))
GLM(yield ~ trt, v1p232) # OK

```

```

$ANOVA
Response : yield
      Df Sum Sq Mean Sq F value Pr(>F)
MODEL      4 59.174  14.793  28.781 0.0012 **
RESIDUALS   5  2.570   0.514
CORRECTED TOTAL 9 61.744
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
      Df Sum Sq Mean Sq F value Pr(>F)
trt    4 59.174  14.793  28.781 0.0012 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```
$`Type II`
      Df Sum Sq Mean Sq F value Pr(>F)
trt    4 59.174   14.793   28.781 0.0012 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
      Df Sum Sq Mean Sq F value Pr(>F)
trt    4 59.174   14.793   28.781 0.0012 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

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

8.2.2 p235

(106) MODEL

```
v1p235 = read.table("C:/G/Rt/Kemp/v1p235.txt", head=TRUE)
v1p235 = af(v1p235,c("density"))
GLM(yield ~ density, v1p235) # OK
```

```
$ANOVA
Response : yield
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL    4 88.007  22.0017   32.198 1.095e-05 ***
RESIDUALS 10  6.833   0.6833
CORRECTED TOTAL 14 94.840
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
density  4 88.007  22.002   32.198 1.095e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
density  4 88.007  22.002  32.198 1.095e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
density  4 88.007  22.002  32.198 1.095e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
      Estimate Std. Error Df t value    Pr(>|t|)
(Intercept) 16.9667     0.47726 10 35.5501 7.362e-12 ***
density10   -4.9667     0.67495 10 -7.3586 2.429e-05 ***
density20   -0.9667     0.67495 10 -1.4322  0.1826
density30    2.0667     0.67495 10  3.0620  0.0120 *
density40    1.0333     0.67495 10  1.5310  0.1568
density50    0.0000     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

```
v1p265 = read.table("C:/G/Rt/Kemp/v1p265.txt", head=TRUE)
v1p265 = af(v1p265,c("trt"))
GLM(y ~ trt + x, v1p265) # OK
```

```
$ANOVA
Response : y
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      3 84.678 28.2260  36.866 4.941e-06 ***
RESIDUALS  11  8.422  0.7656
CORRECTED TOTAL 14 93.100
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
trt    2 66.868  33.434  43.668 5.858e-06 ***
```

```

x      1 17.810  17.810  23.262 0.0005333 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
trt   2 83.147  41.573   54.299 1.996e-06 ***
x      1 17.810  17.810   23.262 0.0005333 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
trt   2 83.147  41.573   54.299 1.996e-06 ***
x      1 17.810  17.810   23.262 0.0005333 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
      Estimate Std. Error Df t value  Pr(>|t|)
(Intercept)   2.7154     0.81801 11  3.3196 0.0068363 **
trt1           6.2245     0.60214 11 10.3374 5.301e-07 ***
trt2           2.9315     0.56116 11  5.2239 0.0002838 ***
trt3           0.0000     0.00000 11
x              0.7733     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

```
GLM(y ~ trt + x %in% trt, vlp265) # OK
```

\$ANOVA

Response : y

```

      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      5 85.711  17.142  20.881 0.0001046 ***
RESIDUALS   9  7.389   0.821
CORRECTED TOTAL 14 93.100

```

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

\$`Type I`

```

      Df Sum Sq Mean Sq F value    Pr(>F)
trt    2 66.868  33.434 40.7254 3.092e-05 ***

```

```

trt:x  3 18.843   6.281   7.6509  0.007578 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
trt      2 66.868   33.434 40.7254 3.092e-05 ***
trt:x    3 18.843    6.281   7.6509  0.007578 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
trt      2  6.1392   3.0696   3.7390 0.065769 .
trt:x    3 18.8433    6.2811   7.6509  0.007578 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
      Estimate Std. Error Df t value Pr(>|t|)
(Intercept)   3.7395     1.25360  9  2.9830 0.015375 *
trt1           4.5929     1.73483  9  2.6475 0.026586 *
trt2           1.2883     1.85702  9   0.6937 0.505359
trt3           0.0000     0.00000  9
trt1:x         0.9759     0.37622  9  2.5938 0.029031 *
trt2:x         0.8957     0.25864  9  3.4630 0.007127 **
trt3:x         0.5448     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

```
GLM(y ~ trt + x + x %in% trt, v1p265) # OK
```

```

$ANOVA
Response : y
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      5 85.711   17.142  20.881 0.0001046 ***
RESIDUALS   9  7.389    0.821
CORRECTED TOTAL 14 93.100
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`

```

```

      Df Sum Sq Mean Sq F value    Pr(>F)
trt     2 66.868   33.434  40.7254 3.092e-05 ***
x       1 17.810   17.810  21.6940  0.001189 **
trt:x   2  1.033    0.517   0.6294  0.554843
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type II`

```

      Df Sum Sq Mean Sq F value    Pr(>F)
trt     2 83.147   41.573  50.6397 1.267e-05 ***
x       1 17.810   17.810  21.6940  0.001189 **
trt:x   2  1.033    0.517   0.6294  0.554843
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type III`

```

      Df Sum Sq Mean Sq F value    Pr(>F)
trt     2  6.1392   3.0696   3.7390 0.065769 .
x       1 17.2071  17.2071  20.9597 0.001331 **
trt:x   2  1.0334   0.5167   0.6294  0.554843
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$Parameter

```

      Estimate Std. Error Df t value Pr(>|t|)
(Intercept)   3.7395     1.25360  9  2.9830  0.01537 *
trt1           4.5929     1.73483  9  2.6475  0.02659 *
trt2           1.2883     1.85702  9   0.6937  0.50536
trt3           0.0000     0.00000  9
x              0.5448     0.26480  9  2.0572  0.06979 .
trt1:x         0.4311     0.46007  9   0.9370  0.37320
trt2:x         0.3509     0.37016  9   0.9481  0.36785
trt3:x         0.0000     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

```

v1p344 = read.table("C:/G/Rt/Kemp/v1p344.txt", head=TRUE)
v1p344 = af(v1p344,c("diet", "litter"))
GLM(gain ~ litter + diet, v1p344)

```

\$ANOVA

Response : gain

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	9	4915.6	546.18	15.544	3.363e-07 ***
RESIDUALS	20	702.8	35.14		
CORRECTED TOTAL	29	5618.4			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
litter	5	4438.0	887.6	25.2608	5.298e-08 ***
diet	4	477.6	119.4	3.3981	0.02824 *

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
litter	5	4438.0	887.6	25.2608	5.298e-08 ***
diet	4	477.6	119.4	3.3981	0.02824 *

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
litter	5	4438.0	887.6	25.2608	5.298e-08 ***
diet	4	477.6	119.4	3.3981	0.02824 *

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	54.357	3.4224	20	15.8828	8.344e-13 ***
litter1	19.940	3.7490	20	5.3187	3.318e-05 ***
litter2	17.100	3.7490	20	4.5612	0.0001897 ***
litter3	20.920	3.7490	20	5.5801	1.839e-05 ***
litter4	26.360	3.7490	20	7.0312	8.062e-07 ***
litter5	41.040	3.7490	20	10.9469	6.767e-10 ***
litter6	0.000	0.0000	20		
diet1	-12.367	3.4224	20	-3.6135	0.0017332 **
diet2	-7.650	3.4224	20	-2.2353	0.0369629 *
diet3	-8.100	3.4224	20	-2.3668	0.0281448 *
diet4	-6.567	3.4224	20	-1.9188	0.0694012 .
diet5	0.000	0.0000	20		

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

8.4.2 p349

(111) MODEL

```
v1p349 = read.table("C:/G/Rt/Kemp/v1p349.txt", head=TRUE)
v1p349 = af(v1p349,c("subject", "exercise"))
GLM(diast ~ subject + exercise + subject:exercise, v1p349) # OK
```

\$ANOVA

Response : diast

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	14	1541.5	110.105	28.475	2.953e-08 ***
RESIDUALS	15	58.0	3.867		
CORRECTED TOTAL	29	1599.5			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
subject	4	905.13	226.283	58.5216	5.672e-09 ***
exercise	2	591.27	295.633	76.4569	1.357e-08 ***
subject:exercise	8	45.07	5.633	1.4569	0.2522

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
subject	4	905.13	226.283	58.5216	5.672e-09 ***
exercise	2	591.27	295.633	76.4569	1.357e-08 ***
subject:exercise	8	45.07	5.633	1.4569	0.2522

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
subject	4	905.13	226.283	58.5216	5.672e-09 ***
exercise	2	591.27	295.633	76.4569	1.357e-08 ***
subject:exercise	8	45.07	5.633	1.4569	0.2522

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	135.0	1.3904	15	97.0913	< 2.2e-16 ***
subject1	0.5	1.9664	15	0.2543	0.8027368
subject2	5.0	1.9664	15	2.5427	0.0225198 *
subject3	-5.5	1.9664	15	-2.7970	0.0135411 *

```

subject4          10.0      1.9664 15  5.0855 0.0001343 ***
subject5           0.0      0.0000 15
exercise1        -12.0      1.9664 15 -6.1026 2.023e-05 ***
exercise2          0.5      1.9664 15  0.2543 0.8027368
exercise3          0.0      0.0000 15
subject1:exercise1  4.0      2.7809 15  1.4384 0.1708608
subject1:exercise2  0.0      2.7809 15  0.0000 1.0000000
subject1:exercise3  0.0      0.0000 15
subject2:exercise1  8.0      2.7809 15  2.8768 0.0115245 *
subject2:exercise2  2.0      2.7809 15  0.7192 0.4830757
subject2:exercise3  0.0      0.0000 15
subject3:exercise1  2.0      2.7809 15  0.7192 0.4830757
subject3:exercise2  2.0      2.7809 15  0.7192 0.4830757
subject3:exercise3  0.0      0.0000 15
subject4:exercise1  2.5      2.7809 15  0.8990 0.3828608
subject4:exercise2  0.0      2.7809 15  0.0000 1.0000000
subject4:exercise3  0.0      0.0000 15
subject5:exercise1  0.0      0.0000 15
subject5:exercise2  0.0      0.0000 15
subject5:exercise3  0.0      0.0000 15
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

8.4.3 p354

(112) MODEL

```

v1p354 = read.table("C:/G/Rt/Kemp/v1p354.txt", head=TRUE)
v1p354 = af(v1p354,c("loc", "block", "HSF"))
GLM(height ~ loc + block %in% loc + HSF + loc:HSF + block:loc:HSF, v1p354) # OK

```

\$ANOVA

Response : height

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	23	40782	1773.12	80.444	< 2.2e-16 ***
RESIDUALS	24	529	22.04		
CORRECTED TOTAL	47	41311			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
loc	1	20336.3	20336.3	922.6314	< 2.2e-16 ***
loc:block	6	1462.3	243.7	11.0573	6.408e-06 ***
HSF	2	12170.7	6085.3	276.0832	< 2.2e-16 ***
loc:HSF	2	6511.2	3255.6	147.7013	3.242e-14 ***

```
loc:block:HSF 12 301.2 25.1 1.1386 0.3769
---
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

\$`Type II`

```
      Df Sum Sq Mean Sq F value    Pr(>F)
loc      1 20336.3 20336.3 922.6314 < 2.2e-16 ***
loc:block 6  1462.3   243.7  11.0573 6.408e-06 ***
HSF       2 12170.7  6085.3  276.0832 < 2.2e-16 ***
loc:HSF   2  6511.2  3255.6  147.7013 3.242e-14 ***
loc:block:HSF 12 301.2   25.1   1.1386 0.3769
---
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

\$`Type III`

```
      Df Sum Sq Mean Sq F value    Pr(>F)
loc      1 20336.3 20336.3 922.6314 < 2.2e-16 ***
loc:block 6  1462.3   243.7  11.0573 6.408e-06 ***
HSF       2 12170.7  6085.3  276.0832 < 2.2e-16 ***
loc:HSF   2  6511.2  3255.6  147.7013 3.242e-14 ***
loc:block:HSF 12 301.2   25.1   1.1386 0.3769
---
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

\$Parameter

```
      Estimate Std. Error Df t value    Pr(>|t|)
(Intercept)      191.0     3.3198 24 57.5342 < 2.2e-16 ***
loc1              22.5     4.6949 24  4.7925 7.039e-05 ***
loc2              0.0     0.0000 24
loc1:block1     -20.0     4.6949 24 -4.2600 0.0002727 ***
loc1:block2      -8.0     4.6949 24 -1.7040 0.1012979
loc1:block3      -9.0     4.6949 24 -1.9170 0.0672189 .
loc1:block4       0.0     0.0000 24
loc2:block1     -10.5     4.6949 24 -2.2365 0.0348764 *
loc2:block2      -4.5     4.6949 24 -0.9585 0.3473697
loc2:block3      10.0     4.6949 24  2.1300 0.0436248 *
loc2:block4       0.0     0.0000 24
HSF1             -3.0     4.6949 24 -0.6390 0.5288766
HSF2              9.5     4.6949 24  2.0235 0.0542951 .
HSF3              0.0     0.0000 24
loc1:HSF1        17.0     6.6395 24  2.5604 0.0171697 *
loc1:HSF2        53.5     6.6395 24  8.0578 2.778e-08 ***
loc1:HSF3         0.0     0.0000 24
loc2:HSF1         0.0     0.0000 24
loc2:HSF2         0.0     0.0000 24
loc2:HSF3         0.0     0.0000 24
loc1:block1:HSF1  8.0     6.6395 24  1.2049 0.2399873
loc1:block1:HSF2 -0.5     6.6395 24 -0.0753 0.9405950
```

```

loc1:block1:HSF3      0.0      0.0000 24
loc1:block2:HSF1     -1.5      6.6395 24 -0.2259 0.8231768
loc1:block2:HSF2     -0.5      6.6395 24 -0.0753 0.9405950
loc1:block2:HSF3      0.0      0.0000 24
loc1:block3:HSF1      4.0      6.6395 24  0.6025 0.5525233
loc1:block3:HSF2      6.5      6.6395 24  0.9790 0.3373533
loc1:block3:HSF3      0.0      0.0000 24
loc1:block4:HSF1      0.0      0.0000 24
loc1:block4:HSF2      0.0      0.0000 24
loc1:block4:HSF3      0.0      0.0000 24
loc2:block1:HSF1     -1.0      6.6395 24 -0.1506 0.8815396
loc2:block1:HSF2      2.0      6.6395 24  0.3012 0.7658364
loc2:block1:HSF3      0.0      0.0000 24
loc2:block2:HSF1     -1.5      6.6395 24 -0.2259 0.8231768
loc2:block2:HSF2      3.5      6.6395 24  0.5271 0.6029315
loc2:block2:HSF3      0.0      0.0000 24
loc2:block3:HSF1    -12.0      6.6395 24 -1.8074 0.0832589 .
loc2:block3:HSF2    -13.0      6.6395 24 -1.9580 0.0619570 .
loc2:block3:HSF3      0.0      0.0000 24
loc2:block4:HSF1      0.0      0.0000 24
loc2:block4:HSF2      0.0      0.0000 24
loc2:block4:HSF3      0.0      0.0000 24
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

8.4.4 p357

(113) MODEL

```

v1p357 = read.table("C:/G/Rt/Kemp/v1p357.txt", head=TRUE)
v1p357 = af(v1p357,c("var", "N"))
GLM(y ~ var + N + var:N, v1p357) # OK

```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	9	4465.5	496.16	14.116	0.000142 ***
RESIDUALS	10	351.5	35.15		
CORRECTED TOTAL	19	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 Std. Error Df t value Pr(>|t|)
(Intercept)    134.0      4.1923 10 31.9637 2.114e-11 ***
var1             5.5      5.9287 10  0.9277 0.375420
var2             0.0      0.0000 10
N1             -17.5      5.9287 10 -2.9517 0.014492 *
N2              25.0      5.9287 10  4.2167 0.001781 **
N3              20.0      5.9287 10  3.3734 0.007081 **
N4               3.5      5.9287 10  0.5903 0.568060
N5               0.0      0.0000 10
var1:N1         -13.0      8.3845 10 -1.5505 0.152072
var1:N2        -32.5      8.3845 10 -3.8762 0.003078 **
var1:N3        -15.5      8.3845 10 -1.8486 0.094254 .
var1:N4          7.0      8.3845 10  0.8349 0.423286
var1:N5          0.0      0.0000 10
var2:N1          0.0      0.0000 10
var2:N2          0.0      0.0000 10
var2:N3          0.0      0.0000 10
var2:N4          0.0      0.0000 10
var2:N5          0.0      0.0000 10
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

8.4.5 p361

(114) MODEL

```
v1p361 = read.table("C:/G/Rt/Kemp/v1p361.txt", head=TRUE)
v1p361 = af(v1p361,c("block", "trt"))
GLM(y ~ block + trt, v1p361) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	4	241.33	60.333	40.222	0.1176
RESIDUALS	1	1.50	1.500		
CORRECTED TOTAL	5	242.83			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	24.333	12.167	8.1111	0.24097
trt	2	217.000	108.500	72.3333	0.08286 .

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	108	54.0	36.000	0.11704
trt	2	217	108.5	72.333	0.08286 .

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	108	54.0	36.000	0.11704
trt	2	217	108.5	72.333	0.08286 .

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	19.5	1.1180	1	17.4413	0.03646 *
block1	-12.0	1.4142	1	-8.4853	0.07468 .
block2	-6.0	1.4142	1	-4.2426	0.14736
block3	0.0	0.0000	1		
trt1	16.0	1.4142	1	11.3137	0.05612 .
trt2	3.0	1.4142	1	2.1213	0.28044
trt3	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 Std. Error Df t value Pr(>|t|)
(Intercept)   102.16     8.7050 12 11.7357 6.195e-08 ***
Row1           12.00     7.6348 12  1.5717 0.141991
Row2           4.00     7.6348 12  0.5239 0.609878
Row3           6.00     7.6348 12  0.7859 0.447183
Row4          -0.40     7.6348 12 -0.0524 0.959079
Row5           0.00     0.0000 12
Col1           5.80     7.6348 12  0.7597 0.462112
Col2          -6.60     7.6348 12 -0.8645 0.404285
Col3          -18.80     7.6348 12 -2.4624 0.029907 *
Col4          -1.80     7.6348 12 -0.2358 0.817593
Col5           0.00     0.0000 12
trt1          -25.00     7.6348 12 -3.2745 0.006648 **
trt2          -3.20     7.6348 12 -0.4191 0.682525
trt3          -7.20     7.6348 12 -0.9430 0.364257
trt4          -9.00     7.6348 12 -1.1788 0.261321
trt5           0.00     0.0000 12
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

8.5.2 p408

(116) MODEL

```
v1p408 = read.table("C:/G/Rt/Kemp/v1p408.txt", head=TRUE)
v1p408 = af(v1p408, c("breed", "farm", "wclass", "dosage"))
GLM(response ~ breed + breed:farm + wclass + dosage + breed:dosage, v1p408) # OK
```

\$ANOVA

Response : response

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	16	4470.2	279.391	140.87	2.039e-13 ***
RESIDUALS	15	29.7	1.983		
CORRECTED TOTAL	31	4500.0			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
breed	1	3280.5	3280.5	1654.0336	< 2.2e-16 ***
breed:farm	6	9.0	1.5	0.7563	0.6146
wclass	3	466.8	155.6	78.4454	2.142e-09 ***
dosage	3	580.2	193.4	97.5210	4.596e-10 ***
breed:dosage	3	133.8	44.6	22.4790	8.366e-06 ***

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
breed	1	3280.5	3280.5	1654.0336	< 2.2e-16 ***
breed:farm	6	9.0	1.5	0.7563	0.6146
wclass	3	466.7	155.6	78.4454	2.142e-09 ***
dosage	3	580.2	193.4	97.5210	4.596e-10 ***
breed:dosage	3	133.8	44.6	22.4790	8.366e-06 ***

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
breed	1	3280.5	3280.5	1654.0336	< 2.2e-16 ***
breed:farm	6	9.0	1.5	0.7563	0.6146
wclass	3	466.8	155.6	78.4454	2.142e-09 ***
dosage	3	580.3	193.4	97.5210	4.596e-10 ***
breed:dosage	3	133.7	44.6	22.4790	8.366e-06 ***

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	168.500	1.02647	15	164.1544	< 2.2e-16 ***
breed1	-19.750	1.31735	15	-14.9922	1.956e-10 ***
breed2	0.000	0.00000	15		
breed1:farm1	0.500	0.99582	15	0.5021	0.6228896
breed1:farm2	-0.500	0.99582	15	-0.5021	0.6228896
breed1:farm3	0.500	0.99582	15	0.5021	0.6228896
breed1:farm4	0.000	0.00000	15		
breed2:farm1	-0.750	0.99582	15	-0.7531	0.4630208

```

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

```

8.5.3 p410

(117) MODEL

```

v1p410 = read.table("C:/G/Rt/Kemp/v1p410.txt", head=TRUE)
v1p410$carry = ifelse(v1p410$carry == 0, 3, v1p410$carry)
v1p410 = af(v1p410, c("period", "sequence", "steer", "trt", "carry"))
GLM(y ~ period + sequence + steer:sequence + trt + carry, v1p410) # OK

```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	17	1302.51	76.618	8.7402	1.572e-05 ***
RESIDUALS	18	157.79	8.766		
CORRECTED TOTAL	35	1460.31			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
period	2	292.06	146.028	16.6580	8.038e-05 ***
sequence	5	326.47	65.294	7.4484	0.0006072 ***
sequence:steer	6	118.50	19.750	2.2530	0.0849122 .
trt	2	549.06	274.528	31.3166	1.377e-06 ***

```

carry          2  16.43   8.215  0.9372 0.4100385
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type II`

```

          Df Sum Sq Mean Sq F value    Pr(>F)
period      2 172.31  86.154  9.8279 0.0013030 **
sequence    5 318.69  63.738  7.2709 0.0006954 ***
sequence:steer 6 118.50  19.750  2.2530 0.0849122 .
trt         2 440.61 220.304 25.1311 6.164e-06 ***
carry       2  16.43   8.215  0.9372 0.4100385
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type III`

```

          Df Sum Sq Mean Sq F value    Pr(>F)
period      2 172.31  86.154  9.8279 0.0013030 **
sequence    5 318.69  63.738  7.2709 0.0006954 ***
sequence:steer 6 118.50  19.750  2.2530 0.0849122 .
trt         2 440.61 220.304 25.1311 6.164e-06 ***
carry       2  16.43   8.215  0.9372 0.4100385
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$Parameter

```

          Estimate Std. Error Df t value  Pr(>|t|)
(Intercept)      52.854      2.3407 18 22.5805 1.177e-14 ***
period1          -6.604      1.5990 18 -4.1302 0.0006286 ***
period2          -0.083      1.2087 18 -0.0689 0.9457953
period3           0.000      0.0000 18
sequence1         3.208      2.4919 18  1.2875 0.2142212
sequence2        -3.000      2.4175 18 -1.2410 0.2305478
sequence3        -6.771      2.4919 18 -2.7172 0.0141265 *
sequence4        -1.438      2.4919 18 -0.5769 0.5711674
sequence5         1.208      2.4919 18  0.4849 0.6335881
sequence6         0.000      0.0000 18
sequence1:steer1  -3.667      2.4175 18 -1.5167 0.1466983
sequence1:steer2   0.000      0.0000 18
sequence1:steer3
sequence1:steer4
sequence1:steer5
sequence1:steer6
sequence1:steer7
sequence1:steer8
sequence1:steer9
sequence1:steer10
sequence1:steer11
sequence1:steer12

```

```

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

```

```

sequence6:steer1
sequence6:steer2
sequence6:steer3
sequence6:steer4
sequence6:steer5
sequence6:steer6
sequence6:steer7
sequence6:steer8
sequence6:steer9
sequence6:steer10
sequence6:steer11  -3.333      2.4175 18 -1.3789 0.1848347
sequence6:steer12   0.000      0.0000 18
trt1                9.542      1.3514 18  7.0606 1.384e-06 ***
trt2                5.521      1.3514 18  4.0853 0.0006946 ***
trt3                0.000      0.0000 18
carry1              0.375      1.8131 18  0.2068 0.8384657
carry2             -1.938      1.8131 18 -1.0686 0.2993665
carry3              0.000      0.0000 18
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

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

```
v1p432 = read.table("C:/G/Rt/Kemp/v1p432.txt", head=TRUE)
v1p432 = af(v1p432,c("V", "Block", "A", "B", "C"))
GLM(Y ~ V + Block:V + A + B + A:B + V:A + V:B + V:A:B + Block:A:V + Block:B:V,
     v1p432) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	94	261663	2783.65	30.584	2.065e-14 ***
RESIDUALS	25	2275	91.02		
CORRECTED TOTAL	119	263939			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	102743	25686	282.2094	< 2.2e-16 ***
V:Block	25	50019	2001	21.9825	1.588e-11 ***
A	1	18451	18451	202.7233	1.692e-13 ***
B	1	78541	78541	862.9280	< 2.2e-16 ***
A:B	1	108	108	1.1899	0.28575
V:A	4	3751	938	10.3023	4.532e-05 ***
V:B	4	307	77	0.8421	0.51168
V:A:B	4	1495	374	4.1058	0.01081 *
V:Block:A	25	3416	137	1.5011	0.15818
V:Block:B	25	2833	113	1.2451	0.29390

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	102743	25686	282.2094	< 2.2e-16 ***
V:Block	25	50019	2001	21.9825	1.588e-11 ***
A	1	18451	18451	202.7233	1.692e-13 ***
B	1	78541	78541	862.9280	< 2.2e-16 ***
A:B	1	108	108	1.1899	0.28575
V:A	4	3751	938	10.3023	4.532e-05 ***
V:B	4	307	77	0.8421	0.51168
V:A:B	4	1495	374	4.1058	0.01081 *
V:Block:A	25	3416	137	1.5011	0.15818
V:Block:B	25	2833	113	1.2451	0.29390

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	102743	25686	282.2094	< 2.2e-16 ***

V:Block	25	50019	2001	21.9825	1.588e-11	***
A	1	18451	18451	202.7233	1.692e-13	***
B	1	78541	78541	862.9280	< 2.2e-16	***
A:B	1	108	108	1.1899	0.28575	
V:A	4	3751	938	10.3023	4.532e-05	***
V:B	4	307	77	0.8421	0.51168	
V:A:B	4	1495	374	4.1058	0.01081	*
V:Block:A	25	3416	137	1.5011	0.15818	
V:Block:B	25	2833	113	1.2451	0.29390	

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

\$Parameter

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

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

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

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

```

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

```

8.6.2 p434

(119) MODEL

```
GLM(Y ~ V + Block:V + A + B + A:B + V:A + V:B + V:A:B, v1p432) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	44	255415	5804.9	51.075	< 2.2e-16 ***
RESIDUALS	75	8524	113.7		
CORRECTED TOTAL	119	263939			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
--	----	--------	---------	---------	--------

V	4	102743	25686	225.9988	< 2.2e-16	***
V:Block	25	50019	2001	17.6040	< 2.2e-16	***
A	1	18451	18451	162.3447	< 2.2e-16	***
B	1	78541	78541	691.0494	< 2.2e-16	***
A:B	1	108	108	0.9529	0.33212	
V:A	4	3751	938	8.2503	1.435e-05	***
V:B	4	307	77	0.6744	0.61182	
V:A:B	4	1495	374	3.2880	0.01541	*

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	102743	25686	225.9988	< 2.2e-16 ***
V:Block	25	50019	2001	17.6040	< 2.2e-16 ***
A	1	18451	18451	162.3447	< 2.2e-16 ***
B	1	78541	78541	691.0494	< 2.2e-16 ***
A:B	1	108	108	0.9529	0.33212
V:A	4	3751	938	8.2503	1.435e-05 ***
V:B	4	307	77	0.6744	0.61182
V:A:B	4	1495	374	3.2880	0.01541 *

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	102743	25686	225.9988	< 2.2e-16 ***
V:Block	25	50019	2001	17.6040	< 2.2e-16 ***
A	1	18451	18451	162.3447	< 2.2e-16 ***
B	1	78541	78541	691.0494	< 2.2e-16 ***
A:B	1	108	108	0.9529	0.33212
V:A	4	3751	938	8.2503	1.435e-05 ***
V:B	4	307	77	0.6744	0.61182
V:A:B	4	1495	374	3.2880	0.01541 *

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

\$Parameter

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

VAm:Block4	-49.75	7.5384	75	-6.5996	5.177e-09	***
VAm:Block5	-21.00	7.5384	75	-2.7857	0.0067590	**
VAm:Block6	0.00	0.0000	75			
VCo:Block1	-57.25	7.5384	75	-7.5945	7.029e-11	***
VCo:Block2	-58.25	7.5384	75	-7.7271	3.938e-11	***
VCo:Block3	-53.25	7.5384	75	-7.0638	7.048e-10	***
VCo:Block4	-38.75	7.5384	75	-5.1404	2.113e-06	***
VCo:Block5	-19.00	7.5384	75	-2.5204	0.0138466	*
VCo:Block6	0.00	0.0000	75			
VFe:Block1	-42.00	7.5384	75	-5.5715	3.771e-07	***
VFe:Block2	-42.75	7.5384	75	-5.6710	2.515e-07	***
VFe:Block3	-30.75	7.5384	75	-4.0791	0.0001116	***
VFe:Block4	-15.75	7.5384	75	-2.0893	0.0400719	*
VFe:Block5	-2.50	7.5384	75	-0.3316	0.7410890	
VFe:Block6	0.00	0.0000	75			
VHa:Block1	-52.00	7.5384	75	-6.8980	1.441e-09	***
VHa:Block2	-59.00	7.5384	75	-7.8266	2.549e-11	***
VHa:Block3	-37.50	7.5384	75	-4.9745	4.038e-06	***
VHa:Block4	-24.75	7.5384	75	-3.2832	0.0015606	**
VHa:Block5	-22.00	7.5384	75	-2.9184	0.0046415	**
VHa:Block6	0.00	0.0000	75			
VPi:Block1	-46.00	7.5384	75	-6.1021	4.234e-08	***
VPi:Block2	-53.75	7.5384	75	-7.1302	5.290e-10	***
VPi:Block3	-51.75	7.5384	75	-6.8649	1.662e-09	***
VPi:Block4	-38.50	7.5384	75	-5.1072	2.407e-06	***
VPi:Block5	-13.50	7.5384	75	-1.7908	0.0773547	.
VPi:Block6	0.00	0.0000	75			
AF	-26.00	6.1551	75	-4.2242	6.669e-05	***
AM	0.00	0.0000	75			
BH	-46.83	6.1551	75	-7.6089	6.600e-11	***
BL	0.00	0.0000	75			
AF:BH	-5.33	8.7046	75	-0.6127	0.5419251	
AF:BL	0.00	0.0000	75			
AM:BH	0.00	0.0000	75			
AM:BL	0.00	0.0000	75			
VAm:AF	33.33	8.7046	75	3.8294	0.0002645	***
VAm:AM	0.00	0.0000	75			
VCo:AF	-15.50	8.7046	75	-1.7807	0.0790155	.
VCo:AM	0.00	0.0000	75			
VFe:AF	5.67	8.7046	75	0.6510	0.5170370	
VFe:AM	0.00	0.0000	75			
VHa:AF	-8.00	8.7046	75	-0.9191	0.3610122	
VHa:AM	0.00	0.0000	75			
VPi:AF	0.00	0.0000	75			
VPi:AM	0.00	0.0000	75			
VAm:BH	0.50	8.7046	75	0.0574	0.9543466	
VAm:BL	0.00	0.0000	75			
VCo:BH	-13.33	8.7046	75	-1.5318	0.1297887	

VCo:BL	0.00	0.0000	75		
VFe:BH	8.17	8.7046	75	0.9382	0.3511512
VFe:BL	0.00	0.0000	75		
VHa:BH	-7.50	8.7046	75	-0.8616	0.3916454
VHa:BL	0.00	0.0000	75		
VPi:BH	0.00	0.0000	75		
VPi:BL	0.00	0.0000	75		
VAm:AF:BH	-15.00	12.3101	75	-1.2185	0.2268497
VAm:AF:BL	0.00	0.0000	75		
VAm:AM:BH	0.00	0.0000	75		
VAm:AM:BL	0.00	0.0000	75		
VCo:AF:BH	19.67	12.3101	75	1.5976	0.1143369
VCo:AF:BL	0.00	0.0000	75		
VCo:AM:BH	0.00	0.0000	75		
VCo:AM:BL	0.00	0.0000	75		
VFe:AF:BH	-12.50	12.3101	75	-1.0154	0.3131683
VFe:AF:BL	0.00	0.0000	75		
VFe:AM:BH	0.00	0.0000	75		
VFe:AM:BL	0.00	0.0000	75		
VHa:AF:BH	15.50	12.3101	75	1.2591	0.2118897
VHa:AF:BL	0.00	0.0000	75		
VHa:AM:BH	0.00	0.0000	75		
VHa:AM:BL	0.00	0.0000	75		
VPi:AF:BH	0.00	0.0000	75		
VPi:AF:BL	0.00	0.0000	75		
VPi:AM:BH	0.00	0.0000	75		
VPi:AM:BL	0.00	0.0000	75		

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

8.6.3 p438

(120) MODEL

```
GLM(Y ~ V + Block:V + C + V:C, v1p432) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	44	255415	5804.9	51.075	< 2.2e-16 ***
RESIDUALS	75	8524	113.7		
CORRECTED TOTAL	119	263939			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	102743	25686	225.9988	< 2.2e-16 ***
V:Block	25	50019	2001	17.6040	< 2.2e-16 ***
C	3	97100	32367	284.7823	< 2.2e-16 ***
V:C	12	5552	463	4.0709	7.23e-05 ***

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	102743	25686	225.9988	< 2.2e-16 ***
V:Block	25	50019	2001	17.6040	< 2.2e-16 ***
C	3	97100	32367	284.7823	< 2.2e-16 ***
V:C	12	5552	463	4.0709	7.23e-05 ***

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	102743	25686	225.9988	< 2.2e-16 ***
V:Block	25	50019	2001	17.6040	< 2.2e-16 ***
C	3	97100	32367	284.7823	< 2.2e-16 ***
V:C	12	5552	463	4.0709	7.23e-05 ***

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

\$Parameter

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

VFe:Block3	-30.75	7.5384	75	-4.0791	0.0001116	***
VFe:Block4	-15.75	7.5384	75	-2.0893	0.0400719	*
VFe:Block5	-2.50	7.5384	75	-0.3316	0.7410890	
VFe:Block6	0.00	0.0000	75			
VHa:Block1	-52.00	7.5384	75	-6.8980	1.441e-09	***
VHa:Block2	-59.00	7.5384	75	-7.8266	2.549e-11	***
VHa:Block3	-37.50	7.5384	75	-4.9745	4.038e-06	***
VHa:Block4	-24.75	7.5384	75	-3.2832	0.0015606	**
VHa:Block5	-22.00	7.5384	75	-2.9184	0.0046415	**
VHa:Block6	0.00	0.0000	75			
VPi:Block1	-46.00	7.5384	75	-6.1021	4.234e-08	***
VPi:Block2	-53.75	7.5384	75	-7.1302	5.290e-10	***
VPi:Block3	-51.75	7.5384	75	-6.8649	1.662e-09	***
VPi:Block4	-38.50	7.5384	75	-5.1072	2.407e-06	***
VPi:Block5	-13.50	7.5384	75	-1.7908	0.0773547	.
VPi:Block6	0.00	0.0000	75			
C1	-78.17	6.1551	75	-12.6996	< 2.2e-16	***
C2	-26.00	6.1551	75	-4.2242	6.669e-05	***
C3	-46.83	6.1551	75	-7.6089	6.600e-11	***
C4	0.00	0.0000	75			
VAm:C1	18.83	8.7046	75	2.1636	0.0336791	*
VAm:C2	33.33	8.7046	75	3.8294	0.0002645	***
VAm:C3	0.50	8.7046	75	0.0574	0.9543466	
VAm:C4	0.00	0.0000	75			
VCo:C1	-9.17	8.7046	75	-1.0531	0.2956825	
VCo:C2	-15.50	8.7046	75	-1.7807	0.0790155	.
VCo:C3	-13.33	8.7046	75	-1.5318	0.1297887	
VCo:C4	0.00	0.0000	75			
VFe:C1	1.33	8.7046	75	0.1532	0.8786707	
VFe:C2	5.67	8.7046	75	0.6510	0.5170370	
VFe:C3	8.17	8.7046	75	0.9382	0.3511512	
VFe:C4	0.00	0.0000	75			
VHa:C1	0.00	8.7046	75	0.0000	1.0000000	
VHa:C2	-8.00	8.7046	75	-0.9191	0.3610122	
VHa:C3	-7.50	8.7046	75	-0.8616	0.3916454	
VHa:C4	0.00	0.0000	75			
VPi:C1	0.00	0.0000	75			
VPi:C2	0.00	0.0000	75			
VPi:C3	0.00	0.0000	75			
VPi:C4	0.00	0.0000	75			

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

8.6.4 p444

(121) MODEL


```
v1p444 = v1p432[v1p432$Block==5,]
GLM(Y ~ V + A + B + A:B + V:A, v1p444) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	11	39278	3570.8	59.787	1.897e-06 ***
RESIDUALS	8	478	59.7		
CORRECTED TOTAL	19	39756			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	19287.7	4821.9	80.7355	1.674e-06 ***
A	1	3380.0	3380.0	56.5927	6.780e-05 ***
B	1	14045.0	14045.0	235.1612	3.247e-07 ***
A:B	1	115.2	115.2	1.9288	0.202326
V:A	4	2450.5	612.6	10.2574	0.003081 **

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	19287.7	4821.9	80.7355	1.674e-06 ***
A	1	3380.0	3380.0	56.5927	6.780e-05 ***
B	1	14045.0	14045.0	235.1612	3.247e-07 ***
A:B	1	115.2	115.2	1.9288	0.202326
V:A	4	2450.5	612.6	10.2574	0.003081 **

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	19287.7	4821.9	80.7355	1.674e-06 ***
A	1	3380.0	3380.0	56.5927	6.780e-05 ***
B	1	14045.0	14045.0	235.1612	3.247e-07 ***
A:B	1	115.2	115.2	1.9288	0.202326
V:A	4	2450.5	612.6	10.2574	0.003081 **

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	720.1	5.9862	8	120.2927	2.554e-14 ***
VAm	-107.0	7.7282	8	-13.8454	7.159e-07 ***
VCo	-57.0	7.7282	8	-7.3756	7.800e-05 ***

VFe	-32.5	7.7282	8	-4.2054	0.002975	**
VHa	-65.0	7.7282	8	-8.4108	3.040e-05	***
VPi	0.0	0.0000	8			
AF	-28.2	8.4658	8	-3.3310	0.010368	*
AM	0.0	0.0000	8			
BH	-48.2	4.8877	8	-9.8614	9.419e-06	***
BL	0.0	0.0000	8			
AF:BH	-9.6	6.9123	8	-1.3888	0.202326	
AF:BL	0.0	0.0000	8			
AM:BH	0.0	0.0000	8			
AM:BL	0.0	0.0000	8			
VAm:AF	42.5	10.9293	8	3.8886	0.004618	**
VAm:AM	0.0	0.0000	8			
VCo:AF	17.0	10.9293	8	1.5554	0.158449	
VCo:AM	0.0	0.0000	8			
VFe:AF	0.0	10.9293	8	0.0000	1.000000	
VFe:AM	0.0	0.0000	8			
VHa:AF	-24.5	10.9293	8	-2.2417	0.055281	.
VHa:AM	0.0	0.0000	8			
VPi:AF	0.0	0.0000	8			
VPi:AM	0.0	0.0000	8			

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

8.6.5 p482

(122) MODEL

```
v1p482 = read.table("C:/G/Rt/Kemp/v1p482.txt", head=TRUE)
v1p482 = af(v1p482,c("block", "A", "B"))
GLM(y ~ block + A + B + A:B, v1p482) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	8	156.88	19.6094	9.8871	9.377e-05 ***
RESIDUALS	15	29.75	1.9833		
CORRECTED TOTAL	23	186.62			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	5	108.38	21.675	10.9286	0.0001415 ***
A	1	4.00	4.000	2.0168	0.1760166
B	1	42.25	42.250	21.3025	0.0003365 ***

```

A:B      1    2.25    2.250  1.1345 0.3036727
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
block  5 31.417   6.283   3.1681 0.0377804 *
A       1  4.000   4.000   2.0168 0.1760166
B       1 42.250  42.250  21.3025 0.0003365 ***
A:B     1  2.250   2.250   1.1345 0.3036727
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
block  5 31.417   6.283   3.1681 0.0377804 *
A       1  4.000   4.000   2.0168 0.1760166
B       1 42.250  42.250  21.3025 0.0003365 ***
A:B     1  2.250   2.250   1.1345 0.3036727
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
      Estimate Std. Error Df t value  Pr(>|t|)
(Intercept)    9.000     0.86241 15 10.4359 2.842e-08 ***
block1         -1.375     1.11337 15 -1.2350  0.23583
block2          1.125     1.11337 15  1.0104  0.32830
block3         -0.125     1.11337 15 -0.1123  0.91210
block4          2.875     1.11337 15  2.5823  0.02082 *
block5          1.250     1.21963 15  1.0249  0.32166
block6          0.000     0.00000 15
A0             -0.250     0.99582 15 -0.2510  0.80518
A1              0.000     0.00000 15
B0             -2.500     0.99582 15 -2.5105  0.02400 *
B1              0.000     0.00000 15
A0:B0          -1.500     1.40831 15 -1.0651  0.30367
A0:B1           0.000     0.00000 15
A1:B0           0.000     0.00000 15
A1:B1           0.000     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

```
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
```

```
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

```
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

```

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	Std. Error	Df	t value	Pr(> t)
(Intercept)	17.250	2.3311	9	7.3999	4.104e-05 ***
rep1	19.500	2.9486	9	6.6132	9.778e-05 ***
rep2	14.000	2.9486	9	4.7480	0.001047 **
rep3	-0.500	2.9486	9	-0.1696	0.869099
rep4	0.000	0.0000	9		
A1	5.375	3.2967	9	1.6304	0.137448
A2	11.375	3.2967	9	3.4504	0.007270 **
A3	0.000	0.0000	9		
rep1:A1	1.500	4.1700	9	0.3597	0.727358
rep1:A2	-9.000	4.1700	9	-2.1583	0.059234 .
rep1:A3	0.000	0.0000	9		
rep2:A1	-11.000	4.1700	9	-2.6379	0.027007 *
rep2:A2	-14.500	4.1700	9	-3.4772	0.006969 **
rep2:A3	0.000	0.0000	9		
rep3:A1	1.000	4.1700	9	0.2398	0.815851
rep3:A2	-3.000	4.1700	9	-0.7194	0.490137
rep3:A3	0.000	0.0000	9		
rep4:A1	0.000	0.0000	9		
rep4:A2	0.000	0.0000	9		
rep4:A3	0.000	0.0000	9		
B1	0.500	2.0850	9	0.2398	0.815851
B2	0.000	0.0000	9		
A1:B1	9.250	2.9486	9	3.1370	0.011985 *
A1:B2	0.000	0.0000	9		


```

A2:B1          7.250      2.9486  9  2.4588  0.036232 *
A2:B2          0.000      0.0000  9
A3:B1          0.000      0.0000  9
A3:B2          0.000      0.0000  9
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

8.8.2 p566

(127) MODEL

```

v1p566 = read.table("C:/G/Rt/Kemp/v1p566.txt", head=TRUE)
v1p566 = af(v1p566, c("subject", "A", "B"))
GLM(y ~ A + B + A:B, v1p566) # OK

```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	5	1469.58	293.92	86.2	5.592e-09 ***
RESIDUALS	12	40.92	3.41		
CORRECTED TOTAL	17	1510.50			

```

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

```

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	2	1390.04	695.02	203.8350	5.466e-10 ***
B	1	76.06	76.06	22.3055	0.0004945 ***
A:B	2	3.49	1.74	0.5112	0.6122667

```

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

```

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	2	1390.04	695.02	203.8350	5.466e-10 ***
B	1	76.06	76.06	22.3055	0.0004945 ***
A:B	2	3.49	1.74	0.5112	0.6122667

```

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

```

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	2	1390.04	695.02	203.8350	5.466e-10 ***
B	1	79.00	79.00	23.1700	0.0004237 ***
A:B	2	3.49	1.74	0.5112	0.6122667

```

---

```

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	54.500	1.3057	12	41.7400	2.309e-14 ***
A1	-23.750	1.5992	12	-14.8516	4.354e-09 ***
A2	-18.167	1.6857	12	-10.7772	1.586e-07 ***
A3	0.000	0.0000	12		
B1	-5.500	1.8465	12	-2.9785	0.01152 *
B2	0.000	0.0000	12		
A1:B1	2.250	2.2615	12	0.9949	0.33943
A1:B2	0.000	0.0000	12		
A2:B1	1.167	2.3839	12	0.4894	0.63338
A2:B2	0.000	0.0000	12		
A3:B1	0.000	0.0000	12		
A3:B2	0.000	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

```
v1p581 = read.table("C:/G/Rt/Kemp/v1p581.txt", head=TRUE)
v1p581 = af(v1p581, c("drug", "person", "time"))
GLM(rate ~ drug + person:drug + time + drug:time, v1p581) # OK
```

\$ANOVA

Response : rate

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	23	2449.5	106.500	12.733	3.469e-11 ***
RESIDUALS	36	301.1	8.364		
CORRECTED TOTAL	59	2750.6			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
drug	2	337.60	168.800	20.1820	1.323e-06 ***
drug:person	12	1498.50	124.875	14.9303	1.501e-10 ***
time	3	256.33	85.444	10.2159	5.230e-05 ***
drug:time	6	357.07	59.511	7.1152	4.707e-05 ***

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
drug	2	337.60	168.800	20.1820	1.323e-06 ***
drug:person	12	1498.50	124.875	14.9303	1.501e-10 ***
time	3	256.33	85.444	10.2159	5.230e-05 ***
drug:time	6	357.07	59.511	7.1152	4.707e-05 ***

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
drug	2	337.60	168.800	20.1820	1.323e-06 ***
drug:person	12	1498.50	124.875	14.9303	1.501e-10 ***
time	3	256.33	85.444	10.2159	5.230e-05 ***
drug:time	6	357.07	59.511	7.1152	4.707e-05 ***

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	71.05	1.8291	36	38.8445	< 2.2e-16 ***
drug1	-2.95	2.5867	36	-1.1404	0.261633
drug2	8.20	2.5867	36	3.1700	0.003108 **
drug3	0.00	0.0000	36		
drug1:person1	7.00	2.0450	36	3.4230	0.001559 **
drug1:person2	10.50	2.0450	36	5.1345	9.954e-06 ***
drug1:person3	5.25	2.0450	36	2.5673	0.014551 *
drug1:person4	4.75	2.0450	36	2.3228	0.025959 *
drug1:person5	0.00	0.0000	36		
drug2:person1	2.75	2.0450	36	1.3448	0.187116
drug2:person2	2.25	2.0450	36	1.1003	0.278524
drug2:person3	-7.25	2.0450	36	-3.5453	0.001109 **
drug2:person4	2.00	2.0450	36	0.9780	0.334599
drug2:person5	0.00	0.0000	36		
drug3:person1	1.25	2.0450	36	0.6113	0.544873
drug3:person2	-3.75	2.0450	36	-1.8338	0.074968 .
drug3:person3	16.50	2.0450	36	8.0685	1.374e-09 ***
drug3:person4	6.75	2.0450	36	3.3008	0.002182 **
drug3:person5	0.00	0.0000	36		
time1	-1.00	1.8291	36	-0.5467	0.587943
time2	0.40	1.8291	36	0.2187	0.828128
time3	-0.60	1.8291	36	-0.3280	0.744787
time4	0.00	0.0000	36		
drug1:time1	-0.80	2.5867	36	-0.3093	0.758897
drug1:time2	8.60	2.5867	36	3.3247	0.002044 **
drug1:time3	9.00	2.5867	36	3.4793	0.001334 **
drug1:time4	0.00	0.0000	36		

drug2:time1	3.20	2.5867	36	1.2371	0.224063
drug2:time2	5.00	2.5867	36	1.9330	0.061138 .
drug2:time3	-1.00	2.5867	36	-0.3866	0.701335
drug2:time4	0.00	0.0000	36		
drug3:time1	0.00	0.0000	36		
drug3:time2	0.00	0.0000	36		
drug3:time3	0.00	0.0000	36		
drug3:time4	0.00	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	Std. Error	Df	t value	Pr(> t)
(Intercept)	31.1250	2.6116	2	11.9181	0.006967 **

```

BLOCK1      -7.6875      3.4548  2 -2.2252 0.156028
BLOCK2      -4.0625      3.4548  2 -1.1759 0.360652
BLOCK3      -1.9375      3.4548  2 -0.5608 0.631370
BLOCK4      -9.3125      3.4548  2 -2.6955 0.114475
BLOCK5       0.0000      0.0000  2
TRT1        -15.2500      3.0156  2 -5.0571 0.036949 *
TRT2         -9.6250      3.3715  2 -2.8548 0.103924
TRT3         -3.1250      3.3715  2 -0.9269 0.451839
TRT4          0.0000      0.0000  2
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

9.1.2 p62

(130) MODEL

```
GLM(Y ~ TRT + BLOCK, v2p53) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	7	518.21	74.030	8.1408	0.1137
RESIDUALS	2	18.19	9.094		
CORRECTED TOTAL	9	536.40			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TRT	3	439.07	146.356	16.0941	0.05907 .
BLOCK	4	79.15	19.786	2.1758	0.33880

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TRT	3	256.812	85.604	9.4135	0.09755 .
BLOCK	4	79.146	19.786	2.1758	0.33880

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TRT	3	256.813	85.604	9.4135	0.09755 .
BLOCK	4	79.146	19.786	2.1758	0.33880

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

```

$Parameter
      Estimate Std. Error Df t value Pr(>|t|)
(Intercept)  31.1250     2.6116  2 11.9181 0.006967 **
TRT1         -15.2500     3.0156  2 -5.0571 0.036949 *
TRT2          -9.6250     3.3715  2 -2.8548 0.103924
TRT3          -3.1250     3.3715  2 -0.9269 0.451839
TRT4           0.0000     0.0000  2
BLOCK1        -7.6875     3.4548  2 -2.2252 0.156028
BLOCK2        -4.0625     3.4548  2 -1.1759 0.360652
BLOCK3        -1.9375     3.4548  2 -0.5608 0.631370
BLOCK4        -9.3125     3.4548  2 -2.6955 0.114475
BLOCK5         0.0000     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

```

v2p82 = read.table("C:/G/Rt/Kemp/v2p82.txt", head=TRUE)
v2p82 = af(v2p82, c("B", "Tx"))
GLM(Y ~ B + Tx, v2p82) # OK

```

```

$ANOVA
Response : Y
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      14  889.11   63.508    6.3183 0.000518 ***
RESIDUALS    15  150.77   10.052
CORRECTED TOTAL 29 1039.89
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
B       9 730.39   81.154    8.0738 0.0002454 ***
Tx      5 158.73   31.745    3.1583 0.0381655 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
B       9 595.74   66.193    6.5854 0.0007602 ***
Tx      5 158.73   31.745    3.1583 0.0381655 *
---

```

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
B	9	595.74	66.193	6.5854	0.0007602 ***
Tx	5	158.73	31.745	3.1583	0.0381655 *

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	42.611	2.2418	15	19.0074	6.589e-12 ***
B1	-3.297	2.7960	15	-1.1792	0.256667
B2	0.836	2.7960	15	0.2990	0.769017
B3	-5.100	2.6943	15	-1.8929	0.077835 .
B4	5.497	2.7960	15	1.9661	0.068079 .
B5	-0.992	2.7960	15	-0.3547	0.727775
B6	2.111	2.7960	15	0.7550	0.461919
B7	2.481	2.6943	15	0.9207	0.371800
B8	6.131	2.6943	15	2.2754	0.037989 *
B9	-10.778	2.7960	15	-3.8547	0.001559 **
B10	0.000	0.0000	15		
Tx1	-3.300	2.2418	15	-1.4720	0.161686
Tx2	-5.042	2.2418	15	-2.2489	0.039971 *
Tx3	-2.900	2.2418	15	-1.2936	0.215373
Tx4	-3.233	2.2418	15	-1.4423	0.169778
Tx5	-8.525	2.2418	15	-3.8027	0.001734 **
Tx6	0.000	0.0000	15		

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

9.2.2 p87

(132) MODEL

```
v2p87 = read.table("C:/G/Rt/Kemp/v2p87.txt", head=TRUE)
GLM(y ~ x1 + x2 + x3 + x4 + x5 + x6, v2p87) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	5	1613.25	322.65	2.2332	0.2282
RESIDUALS	4	577.91	144.48		
CORRECTED TOTAL	9	2191.16			

\$`Type I`


```

      Df Sum Sq Mean Sq F value Pr(>F)
x1  1 1044.48 1044.48   7.2293 0.05473 .
x2  1   89.79   89.79   0.6215 0.47459
x3  1   10.45   10.45   0.0724 0.80124
x4  1  407.08  407.08   2.8176 0.16854
x5  1   61.44   61.44   0.4253 0.54990
x6  0
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type II`
      Df Sum Sq Mean Sq F value Pr(>F)
x1  0
x2  0
x3  0
x4  0
x5  0
x6  0

```

```

$`Type III`
CAUTION: Singularity Exists !
      Df Sum Sq Mean Sq F value Pr(>F)
x1  0
x2  0
x3  0
x4  0
x5  0
x6  0

```

```

$Parameter
      Estimate Std. Error Df t value Pr(>|t|)
(Intercept)  131.100    19.3815  4  6.7642 0.002492 **
x1           11.800     9.8142  4  1.2023 0.295540
x2          -13.533     9.8142  4 -1.3790 0.239998
x3           -5.800     9.8142  4 -0.5910 0.586312
x4          -17.467     9.8142  4 -1.7797 0.149731
x5           -6.400     9.8142  4 -0.6521 0.549902
x6            0.000     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

```
v2p217 = read.table("C:/G/Rt/Kemp/v2p217.txt", head=TRUE)
v2p217 = af(v2p217, c("R", "C", "Tx"))
GLM(Y ~ R + C + Tx, v2p217) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	22	4305.1	195.687	7.5094	0.0002682 ***
RESIDUALS	13	338.8	26.059		
CORRECTED TOTAL	35	4643.9			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	3951.4	1317.15	50.5446	1.998e-07 ***
C	8	168.9	21.11	0.8101	0.6062
Tx	11	184.8	16.80	0.6446	0.7638

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	3403.5	1134.51	43.5360	4.83e-07 ***
C	8	112.4	14.05	0.5390	0.8077
Tx	11	184.8	16.80	0.6446	0.7638

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	3403.5	1134.51	43.5360	4.83e-07 ***
C	8	112.4	14.05	0.5390	0.8077
Tx	11	184.8	16.80	0.6446	0.7638

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	34.208	4.7371	13	7.2214	6.733e-06 ***
R1	-25.542	2.5524	13	-10.0069	1.785e-07 ***
R2	-24.167	2.5524	13	-9.4682	3.379e-07 ***
R3	-12.458	2.5524	13	-4.8810	0.0003001 ***
R4	0.000	0.0000	13		
C1	3.000	4.1681	13	0.7198	0.4844133
C2	1.444	4.1681	13	0.3466	0.7344740
C3	5.000	4.1681	13	1.1996	0.2517026

C4	1.556	4.1681	13	0.3732	0.7150083
C5	0.778	4.1681	13	0.1866	0.8548516
C6	6.333	4.1681	13	1.5195	0.1525804
C7	2.889	4.1681	13	0.6931	0.5004420
C8	5.000	4.1681	13	1.1996	0.2517026
C9	0.000	0.0000	13		
Tx1	6.569	4.6859	13	1.4020	0.1843467
Tx2	7.398	4.6859	13	1.5788	0.1383906
Tx3	6.731	4.6859	13	1.4366	0.1744722
Tx4	5.366	4.6859	13	1.1451	0.2728148
Tx5	4.477	4.6859	13	0.9554	0.3568064
Tx6	8.556	4.8129	13	1.7776	0.0988490
Tx7	6.347	4.6859	13	1.3545	0.1986361
Tx8	5.032	4.6859	13	1.0740	0.3023722
Tx9	6.458	4.6859	13	1.3783	0.1913817
Tx10	8.444	4.8129	13	1.7546	0.1028594
Tx11	0.620	4.6859	13	0.1324	0.8967013
Tx12	0.000	0.0000	13		

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

9.3.2 p234

(134) MODEL

```
v2p234 = read.table("C:/G/Rt/Kemp/v2p234.txt", head=TRUE)
v2p234 = af(v2p234, c("R", "C", "Tx"))
GLM(Y ~ C + R + Tx, v2p234) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	13	426.50	32.808	7.0936	0.1302
RESIDUALS	2	9.25	4.625		
CORRECTED TOTAL	15	435.75			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
C	3	16.25	5.417	1.1712	0.49129
R	3	357.25	119.083	25.7477	0.03762 *
Tx	7	53.00	7.571	1.6371	0.43052

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
--	----	--------	---------	---------	--------

```

C   3  10.25   3.417  0.7387 0.6189
R   3 285.50  95.167 20.5766 0.0467 *
Tx  7  53.00   7.571  1.6371 0.4305

```

```
---
```

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

```
$`Type III`
```

```

      Df Sum Sq Mean Sq F value Pr(>F)
C     3  10.25   3.417  0.7387 0.6189
R     3 285.50  95.167 20.5766 0.0467 *
Tx    7  53.00   7.571  1.6371 0.4305

```

```
---
```

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

```
$Parameter
```

```

      Estimate Std. Error Df t value Pr(>|t|)
(Intercept)  36.375      2.0117 2 18.0819 0.003045 **
C1             0.250      1.8625 2  0.1342 0.905509
C2             2.250      1.8625 2  1.2081 0.350481
C3             0.000      2.1506 2  0.0000 1.000000
C4             0.000      0.0000 2
R1            -9.500      1.8625 2 -5.1008 0.036352 *
R2            -6.000      1.8625 2 -3.2215 0.084343 .
R3             1.000      2.1506 2  0.4650 0.687652
R4             0.000      0.0000 2
Tx1            -6.250      2.6339 2 -2.3729 0.140990
Tx2            -6.750      2.8449 2 -2.3726 0.141016
Tx3            -1.500      2.6339 2 -0.5695 0.626456
Tx4            -3.000      2.4044 2 -1.2477 0.338419
Tx5            -2.750      2.8449 2 -0.9666 0.435712
Tx6            -5.250      2.6339 2 -1.9932 0.184428
Tx7            -4.500      2.8449 2 -1.5817 0.254516
Tx8             0.000      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
```

```

v2p268 = read.table("C:/G/Rt/Kemp/v2p268.txt", head=TRUE)
v2p268 = af(v2p268, c("A", "B", "C"))
GLM(y ~ block + A*B*C, v2p268) # OK

```

```
$ANOVA
```

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	8	1026.00	128.250	24.981	0.0001765 ***
RESIDUALS	7	35.94	5.134		
CORRECTED TOTAL	15	1061.94			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	1	715.56	715.56	139.3791	7.093e-06 ***
A	1	68.06	68.06	13.2574	0.0082753 **
B	1	0.06	0.06	0.0122	0.9152401
A:B	1	0.56	0.56	0.1096	0.7503276
C	1	232.56	232.56	45.2991	0.0002698 ***
A:C	1	0.06	0.06	0.0122	0.9152401
B:C	1	7.56	7.56	1.4730	0.2642229
A:B:C	1	1.56	1.56	0.3043	0.5983312

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	1	715.56	715.56	139.3791	7.093e-06 ***
A	1	68.06	68.06	13.2574	0.0082753 **
B	1	0.06	0.06	0.0122	0.9152401
A:B	1	0.56	0.56	0.1096	0.7503276
C	1	232.56	232.56	45.2991	0.0002698 ***
A:C	1	0.06	0.06	0.0122	0.9152401
B:C	1	7.56	7.56	1.4730	0.2642229
A:B:C	1	1.56	1.56	0.3043	0.5983312

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	1	715.56	715.56	139.3791	7.093e-06 ***
A	1	68.06	68.06	13.2574	0.0082753 **
B	1	0.06	0.06	0.0122	0.9152401
A:B	1	0.56	0.56	0.1096	0.7503276
C	1	232.56	232.56	45.2991	0.0002698 ***
A:C	1	0.06	0.06	0.0122	0.9152401
B:C	1	7.56	7.56	1.4730	0.2642229
A:B:C	1	1.56	1.56	0.3043	0.5983312

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	10.938	2.3356	7	4.6830	0.002253 **
block	13.375	1.1329	7	11.8059	7.093e-06 ***
A0	-4.500	2.2658	7	-1.9860	0.087400 .
A1	0.000	0.0000	7		
B0	1.000	2.2658	7	0.4413	0.672276
B1	0.000	0.0000	7		
A0:B0	0.500	3.2043	7	0.1560	0.880408
A0:B1	0.000	0.0000	7		
A1:B0	0.000	0.0000	7		
A1:B1	0.000	0.0000	7		
C0	-7.000	2.2658	7	-3.0894	0.017582 *
C1	0.000	0.0000	7		
A0:C0	1.500	3.2043	7	0.4681	0.653929
A0:C1	0.000	0.0000	7		
A1:C0	0.000	0.0000	7		
A1:C1	0.000	0.0000	7		
B0:C0	-1.500	3.2043	7	-0.4681	0.653929
B0:C1	0.000	0.0000	7		
B1:C0	0.000	0.0000	7		
B1:C1	0.000	0.0000	7		
A0:B0:C0	-2.500	4.5316	7	-0.5517	0.598331
A0:B0:C1	0.000	0.0000	7		
A0:B1:C0	0.000	0.0000	7		
A0:B1:C1	0.000	0.0000	7		
A1:B0:C0	0.000	0.0000	7		
A1:B0:C1	0.000	0.0000	7		
A1:B1:C0	0.000	0.0000	7		
A1:B1:C1	0.000	0.0000	7		

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

9.4.2 p273

(136) MODEL

```
v2p273 = read.table("C:/G/Rt/Kemp/v2p273.txt", head=TRUE)
v2p273 = af(v2p273, c("block", "A", "B", "C"))
GLM(y ~ block + A*B*C + block:A:B:C, v2p273) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	15	2245.0	149.665	129.44	8.427e-14 ***
RESIDUALS	16	18.5	1.156		
CORRECTED TOTAL	31	2263.5			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	1	1498.78	1498.78	1296.2432	< 2.2e-16 ***
A	1	132.03	132.03	114.1892	1.083e-08 ***
B	1	0.03	0.03	0.0270	0.87148
A:B	1	1.53	1.53	1.3243	0.26673
C	1	504.03	504.03	435.9189	4.926e-13 ***
A:C	1	0.78	0.78	0.6757	0.42316
B:C	1	3.78	3.78	3.2703	0.08938 .
A:B:C	1	2.53	2.53	2.1892	0.15840
block:A:B:C	7	101.47	14.50	12.5367	1.965e-05 ***

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	1	1498.78	1498.78	1296.2432	< 2.2e-16 ***
A	1	132.03	132.03	114.1892	1.083e-08 ***
B	1	0.03	0.03	0.0270	0.87148
A:B	1	1.53	1.53	1.3243	0.26673
C	1	504.03	504.03	435.9189	4.926e-13 ***
A:C	1	0.78	0.78	0.6757	0.42316
B:C	1	3.78	3.78	3.2703	0.08938 .
A:B:C	1	2.53	2.53	2.1892	0.15840
block:A:B:C	7	101.47	14.50	12.5367	1.965e-05 ***

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	1	1498.78	1498.78	1296.2432	< 2.2e-16 ***
A	1	132.03	132.03	114.1892	1.083e-08 ***
B	1	0.03	0.03	0.0270	0.87148
A:B	1	1.53	1.53	1.3243	0.26673
C	1	504.03	504.03	435.9189	4.926e-13 ***
A:C	1	0.78	0.78	0.6757	0.42316
B:C	1	3.78	3.78	3.2703	0.08938 .
A:B:C	1	2.53	2.53	2.1892	0.15840
block:A:B:C	7	101.47	14.50	12.5367	1.965e-05 ***

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	41.0	0.76035	16	53.9229	< 2.2e-16 ***

block1	-18.5	1.07529	16	-17.2047	9.615e-12	***
block2	0.0	0.00000	16			
A0	-6.5	1.07529	16	-6.0449	1.702e-05	***
A1	0.0	0.00000	16			
B0	-2.0	1.07529	16	-1.8600	0.0813758	.
B1	0.0	0.00000	16			
A0:B0	3.5	1.52069	16	2.3016	0.0351358	*
A0:B1	0.0	0.00000	16			
A1:B0	0.0	0.00000	16			
A1:B1	0.0	0.00000	16			
C0	-9.5	1.07529	16	-8.8348	1.495e-07	***
C1	0.0	0.00000	16			
A0:C0	2.5	1.52069	16	1.6440	0.1196805	
A0:C1	0.0	0.00000	16			
A1:C0	0.0	0.00000	16			
A1:C1	0.0	0.00000	16			
B0:C0	-3.0	1.52069	16	-1.9728	0.0660548	.
B0:C1	0.0	0.00000	16			
B1:C0	0.0	0.00000	16			
B1:C1	0.0	0.00000	16			
A0:B0:C0	-1.0	2.15058	16	-0.4650	0.6482037	
A0:B0:C1	0.0	0.00000	16			
A0:B1:C0	0.0	0.00000	16			
A0:B1:C1	0.0	0.00000	16			
A1:B0:C0	0.0	0.00000	16			
A1:B0:C1	0.0	0.00000	16			
A1:B1:C0	0.0	0.00000	16			
A1:B1:C1	0.0	0.00000	16			
block1:A0:B0:C0	7.0	1.52069	16	4.6032	0.0002938	***
block1:A0:B0:C1	4.0	1.52069	16	2.6304	0.0181818	*
block1:A0:B1:C0	3.5	1.52069	16	2.3016	0.0351358	*
block1:A0:B1:C1	3.5	1.52069	16	2.3016	0.0351358	*
block1:A1:B0:C0	13.0	1.52069	16	8.5487	2.321e-07	***
block1:A1:B0:C1	3.5	1.52069	16	2.3016	0.0351358	*
block1:A1:B1:C0	4.0	1.52069	16	2.6304	0.0181818	*
block1:A1:B1:C1	0.0	0.00000	16			
block2:A0:B0:C0	0.0	0.00000	16			
block2:A0:B0:C1	0.0	0.00000	16			
block2:A0:B1:C0	0.0	0.00000	16			
block2:A0:B1:C1	0.0	0.00000	16			
block2:A1:B0:C0	0.0	0.00000	16			
block2:A1:B0:C1	0.0	0.00000	16			
block2:A1:B1:C0	0.0	0.00000	16			
block2:A1:B1:C1	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

```
v2p304 = read.table("C:/G/Rt/Kemp/v2p304.txt", head=TRUE)
v2p304 = af(v2p304, c("rep", "block", "A", "B", "C"))
GLM(y ~ rep + block %in% rep + A*B*C - A:B:C, v2p304) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	9	699.06	77.674	248.56	5.096e-07 ***
RESIDUALS	6	1.88	0.312		
CORRECTED TOTAL	15	700.94			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	390.06	390.06	1248.2	3.428e-08 ***
rep:block	2	8.12	4.06	13.0	0.0065918 **
A	1	18.06	18.06	57.8	0.0002696 ***
B	1	175.56	175.56	561.8	3.702e-07 ***
A:B	1	0.06	0.06	0.2	0.6704121
C	1	68.06	68.06	217.8	6.083e-06 ***
A:C	1	0.06	0.06	0.2	0.6704121
B:C	1	39.06	39.06	125.0	3.056e-05 ***

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	390.06	390.06	1248.2	3.428e-08 ***
rep:block	2	8.12	4.06	13.0	0.0065918 **
A	1	18.06	18.06	57.8	0.0002696 ***
B	1	175.56	175.56	561.8	3.702e-07 ***
A:B	1	0.06	0.06	0.2	0.6704121
C	1	68.06	68.06	217.8	6.083e-06 ***
A:C	1	0.06	0.06	0.2	0.6704121
B:C	1	39.06	39.06	125.0	3.056e-05 ***

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
--	----	--------	---------	---------	--------

rep	1	390.06	390.06	1248.2	3.428e-08	***
rep:block	2	8.12	4.06	13.0	0.0065918	**
A	1	18.06	18.06	57.8	0.0002696	***
B	1	175.56	175.56	561.8	3.702e-07	***
A:B	1	0.06	0.06	0.2	0.6704121	
C	1	68.06	68.06	217.8	6.083e-06	***
A:C	1	0.06	0.06	0.2	0.6704121	
B:C	1	39.06	39.06	125.0	3.056e-05	***

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)	
(Intercept)	35.625	0.44194	6	80.6102	2.454e-10	***
rep1	-10.250	0.39528	6	-25.9307	2.169e-07	***
rep2	0.000	0.00000	6			
rep1:block1	1.750	0.39528	6	4.4272	0.004436	**
rep1:block2	0.000	0.00000	6			
rep1:block3						
rep1:block4						
rep2:block1						
rep2:block2						
rep2:block3	1.000	0.39528	6	2.5298	0.044690	*
rep2:block4	0.000	0.00000	6			
A0	-2.375	0.48412	6	-4.9058	0.002695	**
A1	0.000	0.00000	6			
B0	-9.875	0.48412	6	-20.3977	9.026e-07	***
B1	0.000	0.00000	6			
A0:B0	0.250	0.55902	6	0.4472	0.670412	
A0:B1	0.000	0.00000	6			
A1:B0	0.000	0.00000	6			
A1:B1	0.000	0.00000	6			
C0	-7.375	0.48412	6	-15.2337	5.051e-06	***
C1	0.000	0.00000	6			
A0:C0	0.250	0.55902	6	0.4472	0.670412	
A0:C1	0.000	0.00000	6			
A1:C0	0.000	0.00000	6			
A1:C1	0.000	0.00000	6			
B0:C0	6.250	0.55902	6	11.1803	3.056e-05	***
B0:C1	0.000	0.00000	6			
B1:C0	0.000	0.00000	6			
B1:C1	0.000	0.00000	6			

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

9.5.2 p309

(138) MODEL

```
GLM(y ~ rep*A*B*C, v2p304) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	15	700.94	46.729		
RESIDUALS	0	0.00			
CORRECTED TOTAL	15	700.94			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	390.06	390.06		
A	1	18.06	18.06		
rep:A	1	0.06	0.06		
B	1	175.56	175.56		
rep:B	1	1.56	1.56		
A:B	1	0.06	0.06		
rep:A:B	1	0.06	0.06		
C	1	68.06	68.06		
rep:C	1	0.06	0.06		
A:C	1	0.06	0.06		
rep:A:C	1	0.06	0.06		
B:C	1	39.06	39.06		
rep:B:C	1	0.06	0.06		
A:B:C	1	7.56	7.56		
rep:A:B:C	1	0.56	0.56		

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	390.06	390.06		
A	1	18.06	18.06		
rep:A	1	0.06	0.06		
B	1	175.56	175.56		
rep:B	1	1.56	1.56		
A:B	1	0.06	0.06		
rep:A:B	1	0.06	0.06		
C	1	68.06	68.06		
rep:C	1	0.06	0.06		
A:C	1	0.06	0.06		
rep:A:C	1	0.06	0.06		
B:C	1	39.06	39.06		
rep:B:C	1	0.06	0.06		
A:B:C	1	7.56	7.56		

```
rep:A:B:C  1    0.56    0.56
```

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	390.06	390.06		
A	1	18.06	18.06		
rep:A	1	0.06	0.06		
B	1	175.56	175.56		
rep:B	1	1.56	1.56		
A:B	1	0.06	0.06		
rep:A:B	1	0.06	0.06		
C	1	68.06	68.06		
rep:C	1	0.06	0.06		
A:C	1	0.06	0.06		
rep:A:C	1	0.06	0.06		
B:C	1	39.06	39.06		
rep:B:C	1	0.06	0.06		
A:B:C	1	7.56	7.56		
rep:A:B:C	1	0.56	0.56		

```
$Parameter
```

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	35		0		
rep1	-9		0		
rep2	0		0		
A0	-1		0		
A1	0		0		
rep1:A0	0		0		
rep1:A1	0		0		
rep2:A0	0		0		
rep2:A1	0		0		
B0	-8		0		
B1	0		0		
rep1:B0	-1		0		
rep1:B1	0		0		
rep2:B0	0		0		
rep2:B1	0		0		
A0:B0	-2		0		
A0:B1	0		0		
A1:B0	0		0		
A1:B1	0		0		
rep1:A0:B0	-1		0		
rep1:A0:B1	0		0		
rep1:A1:B0	0		0		
rep1:A1:B1	0		0		
rep2:A0:B0	0		0		
rep2:A0:B1	0		0		
rep2:A1:B0	0		0		

rep2:A1:B1	0	0
C0	-6	0
C1	0	0
rep1:C0	0	0
rep1:C1	0	0
rep2:C0	0	0
rep2:C1	0	0
A0:C0	-2	0
A0:C1	0	0
A1:C0	0	0
A1:C1	0	0
rep1:A0:C0	-1	0
rep1:A0:C1	0	0
rep1:A1:C0	0	0
rep1:A1:C1	0	0
rep2:A0:C0	0	0
rep2:A0:C1	0	0
rep2:A1:C0	0	0
rep2:A1:C1	0	0
B0:C0	4	0
B0:C1	0	0
B1:C0	0	0
B1:C1	0	0
rep1:B0:C0	-1	0
rep1:B0:C1	0	0
rep1:B1:C0	0	0
rep1:B1:C1	0	0
rep2:B0:C0	0	0
rep2:B0:C1	0	0
rep2:B1:C0	0	0
rep2:B1:C1	0	0
A0:B0:C0	4	0
A0:B0:C1	0	0
A0:B1:C0	0	0
A0:B1:C1	0	0
A1:B0:C0	0	0
A1:B0:C1	0	0
A1:B1:C0	0	0
A1:B1:C1	0	0
rep1:A0:B0:C0	3	0
rep1:A0:B0:C1	0	0
rep1:A0:B1:C0	0	0
rep1:A0:B1:C1	0	0
rep1:A1:B0:C0	0	0
rep1:A1:B0:C1	0	0
rep1:A1:B1:C0	0	0
rep1:A1:B1:C1	0	0
rep2:A0:B0:C0	0	0

rep2:A0:B0:C1	0	0
rep2:A0:B1:C0	0	0
rep2:A0:B1:C1	0	0
rep2:A1:B0:C0	0	0
rep2:A1:B0:C1	0	0
rep2:A1:B1:C0	0	0
rep2:A1:B1:C1	0	0

9.6 Chapter 9

9.6.1 p343

(139) MODEL

```
v2p343 = read.table("C:/G/Rt/Kemp/v2p343.txt", head=TRUE)
v2p343 = af(v2p343, c("rep", "block", "A", "B", "C"))
GLM(y ~ rep + block %in% rep + A*B*C - A:B:C, v2p343) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	17	1889.8	111.167	14.659	0.001608 **
RESIDUALS	6	45.5	7.583		
CORRECTED TOTAL	23	1935.3			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	2	1537.33	768.67	101.3626	2.375e-05 ***
rep:block	9	127.00	14.11	1.8608	0.23163
A	1	36.00	36.00	4.7473	0.07218 .
B	1	36.00	36.00	4.7473	0.07218 .
A:B	1	12.25	12.25	1.6154	0.25079
C	1	56.25	56.25	7.4176	0.03448 *
A:C	1	81.00	81.00	10.6813	0.01707 *
B:C	1	4.00	4.00	0.5275	0.49502

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	2	1537.33	768.67	101.3626	2.375e-05 ***
rep:block	9	119.83	13.31	1.7558	0.25388
A	1	36.00	36.00	4.7473	0.07218 .
B	1	36.00	36.00	4.7473	0.07218 .

```

A:B      1   12.25   12.25   1.6154   0.25079
C        1   56.25   56.25   7.4176   0.03448 *
A:C      1   81.00   81.00  10.6813   0.01707 *
B:C      1    4.00    4.00   0.5275   0.49502
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type III`

```

      Df Sum Sq Mean Sq F value    Pr(>F)
rep      2 1537.33  768.67 101.3626 2.375e-05 ***
rep:block 9  119.83   13.31   1.7558  0.25388
A         1   36.00   36.00   4.7473  0.07218 .
B         1   36.00   36.00   4.7473  0.07218 .
A:B       1   12.25   12.25   1.6154  0.25079
C         1   56.25   56.25   7.4176  0.03448 *
A:C       1   81.00   81.00  10.6813  0.01707 *
B:C       1    4.00    4.00   0.5275  0.49502
---

```

```

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

```

\$Parameter

```

      Estimate Std. Error Df t value    Pr(>|t|)
(Intercept)   40.50      2.3848  6 16.9822 2.666e-06 ***
rep1          -22.75      3.0788  6 -7.3892 0.0003153 ***
rep2          -17.75      3.0788  6 -5.7652 0.0011880 **
rep3           0.00      0.0000  6
rep1:block1     1.25      3.0788  6  0.4060 0.6988260
rep1:block2     4.50      3.3727  6  1.3342 0.2305270
rep1:block3     3.25      3.0788  6  1.0556 0.3317912
rep1:block4     0.00      0.0000  6
rep1:block5
rep1:block6
rep1:block7
rep1:block8
rep1:block9
rep1:block10
rep1:block11
rep1:block12
rep2:block1
rep2:block2
rep2:block3
rep2:block4
rep2:block5     9.00      3.0788  6  2.9232 0.0265209 *
rep2:block6     7.50      3.3727  6  2.2237 0.0678471 .
rep2:block7     4.50      3.0788  6  1.4616 0.1941629
rep2:block8     0.00      0.0000  6
rep2:block9
rep2:block10

```

```

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

```

9.6.2 p348

(140) MODEL

```
GLM(y ~ rep + A*B*C + block %in% rep, v2p343) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	17	1889.8	111.167	14.659	0.001608 **
RESIDUALS	6	45.5	7.583		

CORRECTED TOTAL 23 1935.3

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
rep	2	1537.33	768.67	101.3626	2.375e-05	***
A	1	88.17	88.17	11.6264	0.01432	*
B	1	37.50	37.50	4.9451	0.06785	.
A:B	1	2.67	2.67	0.3516	0.57484	
C	1	66.67	66.67	8.7912	0.02512	*
A:C	1	37.50	37.50	4.9451	0.06785	.
B:C	1	0.17	0.17	0.0220	0.88700	
A:B:C	1	24.00	24.00	3.1648	0.12555	
rep:block	8	95.83	11.98	1.5797	0.29730	

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
rep	2	1537.33	768.67	101.3626	2.375e-05	***
A	1	36.00	36.00	4.7473	0.07218	.
B	1	36.00	36.00	4.7473	0.07218	.
A:B	1	12.25	12.25	1.6154	0.25079	
C	1	56.25	56.25	7.4176	0.03448	*
A:C	1	81.00	81.00	10.6813	0.01707	*
B:C	1	4.00	4.00	0.5275	0.49502	
A:B:C	0					
rep:block	8	95.83	11.98	1.5797	0.29730	

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

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
rep	2	1537.33	768.67	101.3626	2.375e-05	***
A	1	36.00	36.00	4.7473	0.07218	.
B	1	36.00	36.00	4.7473	0.07218	.
A:B	1	12.25	12.25	1.6154	0.25079	
C	1	56.25	56.25	7.4176	0.03448	*
A:C	1	81.00	81.00	10.6813	0.01707	*
B:C	1	4.00	4.00	0.5275	0.49502	
A:B:C	0					
rep:block	8	95.83	11.98	1.5797	0.29730	

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)	
(Intercept)	40.50	2.3848	6	16.9822	2.666e-06	***
rep1	-22.75	3.0788	6	-7.3892	0.0003153	***
rep2	-17.75	3.0788	6	-5.7652	0.0011880	**
rep3	0.00	0.0000	6			
A0	-8.75	3.3727	6	-2.5944	0.0409706	*
A1	0.00	0.0000	6			
B0	-3.25	3.8944	6	-0.8345	0.4359464	
B1	0.00	0.0000	6			
A0:B0	2.50	6.7454	6	0.3706	0.7236497	
A0:B1	0.00	0.0000	6			
A1:B0	0.00	0.0000	6			
A1:B1	0.00	0.0000	6			
C0	-6.75	3.8944	6	-1.7332	0.1337546	
C1	0.00	0.0000	6			
A0:C0	8.00	6.7454	6	1.1860	0.2804551	
A0:C1	0.00	0.0000	6			
A1:C0	0.00	0.0000	6			
A1:C1	0.00	0.0000	6			
B0:C0	-3.00	6.7454	6	-0.4447	0.6720948	
B0:C1	0.00	0.0000	6			
B1:C0	0.00	0.0000	6			
B1:C1	0.00	0.0000	6			
A0:B0:C0	2.00	12.3153	6	0.1624	0.8763224	
A0:B0:C1	0.00	0.0000	6			
A0:B1:C0	0.00	0.0000	6			
A0:B1:C1	0.00	0.0000	6			
A1:B0:C0	0.00	0.0000	6			
A1:B0:C1	0.00	0.0000	6			
A1:B1:C0	0.00	0.0000	6			
A1:B1:C1	0.00	0.0000	6			
rep1:block1	0.75	4.3541	6	0.1723	0.8689036	
rep1:block2	4.50	3.3727	6	1.3342	0.2305270	
rep1:block3	2.75	4.3541	6	0.6316	0.5509461	
rep1:block4	0.00	0.0000	6			
rep1:block5						
rep1:block6						
rep1:block7						
rep1:block8						
rep1:block9						
rep1:block10						
rep1:block11						
rep1:block12						
rep2:block1						
rep2:block2						
rep2:block3						
rep2:block4						
rep2:block5	8.50	4.3541	6	1.9522	0.0987607	.

```

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

```

9.6.3 p353

(141) MODEL

```

v2p353 = read.table("C:/G/Rt/Kemp/v2p353.txt", head=TRUE)
v2p353 = af(v2p353, c("rep", "block", "A", "B", "C", "D"))
GLM(y ~ rep + rep:block + A*B*C*D - A:B:C:D, v2p353) # OK

```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	21	7132.2	339.63	56.022	9.795e-08 ***
RESIDUALS	10	60.6	6.06		
CORRECTED TOTAL	31	7192.9			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	5940.5	5940.5	979.8763	2.600e-11 ***
rep:block	6	777.4	129.6	21.3711	3.675e-05 ***
A	1	171.1	171.1	28.2268	0.0003412 ***
B	1	18.0	18.0	2.9691	0.1155937
A:B	1	1.6	1.6	0.2577	0.6226914

C	1	120.1	120.1	19.8144	0.0012326	**
A:C	1	0.6	0.6	0.0928	0.7669127	
B:C	1	2.0	2.0	0.3299	0.5784103	
A:B:C	1	4.5	4.5	0.7423	0.4091189	
D	1	6.1	6.1	1.0103	0.3385304	
A:D	1	1.1	1.1	0.1856	0.6757693	
B:D	1	5.1	5.1	0.8351	0.3823203	
A:B:D	1	0.5	0.5	0.0825	0.7798349	
C:D	1	1.6	1.6	0.2577	0.6226914	
A:C:D	1	10.1	10.1	1.6701	0.2253083	
B:C:D	1	72.0	72.0	11.8763	0.0062660	**

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
rep	1	5940.5	5940.5	979.8763	2.6e-11	***
rep:block	6	406.9	67.8	11.1856	0.0006129	***
A	1	171.1	171.1	28.2268	0.0003412	***
B	1	18.0	18.0	2.9691	0.1155937	
A:B	1	1.6	1.6	0.2577	0.6226914	
C	1	120.1	120.1	19.8144	0.0012326	**
A:C	1	0.6	0.6	0.0928	0.7669127	
B:C	1	2.0	2.0	0.3299	0.5784103	
A:B:C	1	4.5	4.5	0.7423	0.4091189	
D	1	6.1	6.1	1.0103	0.3385304	
A:D	1	1.1	1.1	0.1856	0.6757693	
B:D	1	5.1	5.1	0.8351	0.3823203	
A:B:D	1	0.5	0.5	0.0825	0.7798349	
C:D	1	1.6	1.6	0.2577	0.6226914	
A:C:D	1	10.1	10.1	1.6701	0.2253083	
B:C:D	1	72.0	72.0	11.8763	0.0062660	**

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
rep	1	5940.5	5940.5	979.8763	2.6e-11	***
rep:block	6	406.9	67.8	11.1856	0.0006129	***
A	1	171.1	171.1	28.2268	0.0003412	***
B	1	18.0	18.0	2.9691	0.1155937	
A:B	1	1.6	1.6	0.2577	0.6226914	
C	1	120.1	120.1	19.8144	0.0012326	**
A:C	1	0.6	0.6	0.0928	0.7669127	
B:C	1	2.0	2.0	0.3299	0.5784103	
A:B:C	1	4.5	4.5	0.7423	0.4091189	
D	1	6.1	6.1	1.0103	0.3385304	
A:D	1	1.1	1.1	0.1856	0.6757693	

B:D	1	5.1	5.1	0.8351	0.3823203
A:B:D	1	0.5	0.5	0.0825	0.7798349
C:D	1	1.6	1.6	0.2577	0.6226914
A:C:D	1	10.1	10.1	1.6701	0.2253083
B:C:D	1	72.0	72.0	11.8763	0.0062660 **

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)	
(Intercept)	61.438	2.0416	10	30.0934	3.842e-11	***
rep1	-32.875	2.1323	10	-15.4173	2.685e-08	***
rep2	0.000	0.0000	10			
rep1:block1	-3.125	2.1323	10	-1.4655	0.1735006	
rep1:block2	5.250	2.4622	10	2.1322	0.0588002	.
rep1:block3	9.125	2.1323	10	4.2793	0.0016131	**
rep1:block4	0.000	0.0000	10			
rep1:block5						
rep1:block6						
rep1:block7						
rep1:block8						
rep2:block1						
rep2:block2						
rep2:block3						
rep2:block4						
rep2:block5	-10.625	2.1323	10	-4.9828	0.0005512	***
rep2:block6	-4.250	2.4622	10	-1.7261	0.1150383	
rep2:block7	3.625	2.1323	10	1.7000	0.1199674	
rep2:block8	0.000	0.0000	10			
A0	-6.375	2.6116	10	-2.4411	0.0347860	*
A1	0.000	0.0000	10			
B0	-3.750	2.6116	10	-1.4359	0.1815604	
B1	0.000	0.0000	10			
A0:B0	-0.250	3.4821	10	-0.0718	0.9441800	
A0:B1	0.000	0.0000	10			
A1:B0	0.000	0.0000	10			
A1:B1	0.000	0.0000	10			
C0	-10.250	2.6116	10	-3.9248	0.0028439	**
C1	0.000	0.0000	10			
A0:C0	4.500	3.4821	10	1.2923	0.2253083	
A0:C1	0.000	0.0000	10			
A1:C0	0.000	0.0000	10			
A1:C1	0.000	0.0000	10			
B0:C0	8.500	3.0156	10	2.8187	0.0182015	*
B0:C1	0.000	0.0000	10			
B1:C0	0.000	0.0000	10			
B1:C1	0.000	0.0000	10			
A0:B0:C0	-3.000	3.4821	10	-0.8615	0.4091189	

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

```
v2p388 = read.table("C:/G/Rt/Kemp/v2p388.txt", head=TRUE)
v2p388 = af(v2p388, c("rep", "block", "A", "B"))
GLM(y ~ rep + A*B + rep:block, v2p388) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	11	1136.8	103.343	124.01	3.698e-06 ***
RESIDUALS	6	5.0	0.833		
CORRECTED TOTAL	17	1141.8			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	410.89	410.89	493.0667	5.455e-07 ***
A	2	228.11	114.06	136.8667	9.868e-06 ***
B	2	3.44	1.72	2.0667	0.207585
A:B	4	464.22	116.06	139.2667	4.801e-06 ***
rep:block	2	30.11	15.06	18.0667	0.002888 **

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	410.89	410.89	493.0667	5.455e-07 ***
A	2	228.11	114.06	136.8667	9.868e-06 ***
B	2	3.44	1.72	2.0667	0.207585
A:B	2	18.78	9.39	11.2667	0.009298 **
rep:block	2	30.11	15.06	18.0667	0.002888 **

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

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	410.89	410.89	493.0667	5.455e-07 ***
A	2	228.11	114.06	136.8667	9.868e-06 ***
B	2	3.44	1.72	2.0667	0.207585
A:B	2	18.78	9.39	11.2667	0.009298 **
rep:block	2	30.11	15.06	18.0667	0.002888 **

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)	
(Intercept)	42.833	0.74536	6	57.4669	1.865e-09	***
rep1	-12.667	0.74536	6	-16.9941	2.655e-06	***
rep2	0.000	0.00000	6			
A0	-16.167	1.05409	6	-15.3370	4.854e-06	***
A1	-18.500	1.05409	6	-17.5506	2.196e-06	***
A2	0.000	0.00000	6			
B0	-10.167	1.05409	6	-9.6449	7.115e-05	***
B1	-13.500	1.05409	6	-12.8072	1.392e-05	***
B2	0.000	0.00000	6			
A0:B0	3.833	1.58114	6	2.4244	0.0515527	.
A0:B1	18.667	1.58114	6	11.8058	2.232e-05	***
A0:B2	0.000	0.00000	6			
A1:B0	26.167	1.58114	6	16.5493	3.104e-06	***
A1:B1	18.833	1.58114	6	11.9112	2.120e-05	***
A1:B2	0.000	0.00000	6			
A2:B0	0.000	0.00000	6			
A2:B1	0.000	0.00000	6			
A2:B2	0.000	0.00000	6			
rep1:block1	3.000	1.05409	6	2.8460	0.0293332	*
rep1:block2	6.333	1.05409	6	6.0083	0.0009575	***
rep1:block3	0.000	0.00000	6			
rep1:block4						
rep1:block5						
rep1:block6						
rep2:block1						
rep2:block2						
rep2:block3						
rep2:block4	0.000	0.00000	6			
rep2:block5	0.000	0.00000	6			
rep2:block6	0.000	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

```
v2p570 = read.table("C:/G/Rt/Kemp/v2p570.txt", head=TRUE)
v2p570 = af(v2p570, c("A", "B", "C", "D"))
GLM(Y ~ A + B + C + D + A:B + A:C + A:D + B:C + B:D + C:D, v2p570) # OK
```


\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	8	22.222	2.7778		
RESIDUALS	0	0.000			
CORRECTED TOTAL	8	22.222			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	2	2.8889	1.4444		
B	2	2.8889	1.4444		
C	2	1.5556	0.7778		
D	2	14.8889	7.4444		
A:B	0				
A:C	0				
A:D	0				
B:C	0				
B:D	0				
C:D	0				

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	0				
B	0				
C	0				
D	0				
A:B	0				
A:C	0				
A:D	0				
B:C	0				
B:D	0				
C:D	0				

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	0				
B	0				
C	0				
D	0				
A:B	0				
A:C	0				
A:D	0				
B:C	0				
B:D	0				
C:D	0				

\$Parameter

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

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

9.8.2 p578

(144) MODEL

```
v2p578 = read.table("C:/G/Rt/Kemp/v2p578.txt", head=TRUE)
v2p578 = af(v2p578, 1:11)
GLM(Y ~ A + B + C + D + E + F + G + H + J + K + L, v2p578) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	11	575	52.273		
RESIDUALS	0	0			
CORRECTED TOTAL	11	575			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	3.000	3.000		
B	1	27.000	27.000		
C	1	12.000	12.000		
D	1	16.333	16.333		
E	1	176.333	176.333		
F	1	133.333	133.333		
G	1	1.333	1.333		
H	1	21.333	21.333		

J	1	108.000	108.000
K	1	1.333	1.333
L	1	75.000	75.000

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	3.000	3.000		
B	1	27.000	27.000		
C	1	12.000	12.000		
D	1	16.333	16.333		
E	1	176.333	176.333		
F	1	133.333	133.333		
G	1	1.333	1.333		
H	1	21.333	21.333		
J	1	108.000	108.000		
K	1	1.333	1.333		
L	1	75.000	75.000		

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	3.000	3.000		
B	1	27.000	27.000		
C	1	12.000	12.000		
D	1	16.333	16.333		
E	1	176.333	176.333		
F	1	133.333	133.333		
G	1	1.333	1.333		
H	1	21.333	21.333		
J	1	108.000	108.000		
K	1	1.333	1.333		
L	1	75.000	75.000		

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	21.0000		0		
A0	1.0000		0		
A1	0.0000		0		
B0	3.0000		0		
B1	0.0000		0		
C0	2.0000		0		
C1	0.0000		0		
D0	2.3333		0		
D1	0.0000		0		
E0	7.6667		0		
E1	0.0000		0		
F0	6.6667		0		
F1	0.0000		0		
G0	0.6667		0		

G1	0.0000	0
H0	-2.6667	0
H1	0.0000	0
J0	-6.0000	0
J1	0.0000	0
K0	-0.6667	0
K1	0.0000	0
L0	-5.0000	0
L1	0.0000	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	Std. Error	Df	t value	Pr(> t)
(Intercept)	26.5	1.1180	1	23.7023	0.02684 *
E0	6.0	1.1547	1	5.1962	0.12104
E1	0.0	0.0000	1		
F0	1.5	1.0408	1	1.4412	0.38618
F1	0.0	0.0000	1		
E0:F0	-4.5	1.0408	1	-4.3235	0.14470
E0:F1	0.0	0.0000	1		
E1:F0	0.0	0.0000	1		
E1:F1	0.0	0.0000	1		
J0	-11.5	1.0408	1	-11.0488	0.05746 .
J1	0.0	0.0000	1		
E0:J0	0.5	1.0408	1	0.4804	0.71490
E0:J1	0.0	0.0000	1		
E1:J0	0.0	0.0000	1		
E1:J1	0.0	0.0000	1		
F0:J0	12.5	1.0408	1	12.0096	0.05289 .
F0:J1	0.0	0.0000	1		
F1:J0	0.0	0.0000	1		
F1:J1	0.0	0.0000	1		
L0	-3.5	1.0408	1	-3.3627	0.18402
L1	0.0	0.0000	1		
E0:L0	3.5	1.0408	1	3.3627	0.18402
E0:L1	0.0	0.0000	1		
E1:L0	0.0	0.0000	1		
E1:L1	0.0	0.0000	1		

```

F0:L0          0.5      1.0408  1   0.4804  0.71490
F0:L1          0.0      0.0000  1
F1:L0          0.0      0.0000  1
F1:L1          0.0      0.0000  1
J0:L0         -1.5      1.0408  1  -1.4412  0.38618
J0:L1          0.0      0.0000  1
J1:L0          0.0      0.0000  1
J1:L1          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

```

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

(147) MODEL

```
GLM(y ~ A + B + C + A:C, v2p619) # OK
```

```
$ANOVA
Response : y
      Df Sum Sq Mean Sq F value Pr(>F)
MODEL      4 26.0952   6.5238   2.4464 0.3106
RESIDUALS   2  5.3333   2.6667
CORRECTED TOTAL 6 31.4286
```

```
$`Type I`
      Df Sum Sq Mean Sq F value Pr(>F)
A      1 13.7619 13.7619   5.1607 0.1511
B      1  1.6667  1.6667   0.6250 0.5120
C      1 10.0000 10.0000   3.7500 0.1924
A:C    1  0.6667  0.6667   0.2500 0.6667
```

```
$`Type II`
      Df Sum Sq Mean Sq F value Pr(>F)
A      1 19.6000 19.6000   7.35 0.1134
B      1  2.6667  2.6667   1.00 0.4226
```



```
C      1 10.0000 10.0000      3.75 0.1924
A:C    1  0.6667  0.6667      0.25 0.6667
```

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	16.6667	16.6667	6.2500	0.1296
B	1	2.6667	2.6667	1.0000	0.4226
C	1	8.1667	8.1667	3.0625	0.2222
A:C	1	0.6667	0.6667	0.2500	0.6667

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	12.8333	1.3333	2	9.6250	0.01062 *
A0	-4.0000	1.6330	2	-2.4495	0.13397
A1	0.0000	0.0000	2		
B0	1.3333	1.3333	2	1.0000	0.42265
B1	0.0000	0.0000	2		
C0	-3.0000	1.6330	2	-1.8371	0.20759
C1	0.0000	0.0000	2		
A0:C0	1.3333	2.6667	2	0.5000	0.66667
A0:C1	0.0000	0.0000	2		
A1:C0	0.0000	0.0000	2		
A1:C1	0.0000	0.0000	2		

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

(148) MODEL

```
GLM(y ~ A + B + C + B:C, v2p619) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	4	26.0952	6.5238	2.4464	0.3106
RESIDUALS	2	5.3333	2.6667		
CORRECTED TOTAL	6	31.4286			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	13.7619	13.7619	5.1607	0.1511
B	1	1.6667	1.6667	0.6250	0.5120
C	1	10.0000	10.0000	3.7500	0.1924
B:C	1	0.6667	0.6667	0.2500	0.6667

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	16.6667	16.6667	6.25	0.1296

```

B      1  3.6000  3.6000      1.35 0.3652
C      1 10.0000 10.0000      3.75 0.1924
B:C    1  0.6667  0.6667      0.25 0.6667

```

\$`Type III`

```

      Df Sum Sq Mean Sq F value Pr(>F)
A      1 16.6667 16.6667  6.2500 0.1296
B      1  2.6667  2.6667  1.0000 0.4226
C      1  8.1667  8.1667  3.0625 0.2222
B:C    1  0.6667  0.6667  0.2500 0.6667

```

\$Parameter

```

      Estimate Std. Error Df t value Pr(>|t|)
(Intercept) 12.1667      1.3333 2  9.1250  0.0118 *
A0           -3.3333      1.3333 2 -2.5000  0.1296
A1            0.0000      0.0000 2
B0            2.0000      1.6330 2  1.2247  0.3453
B1            0.0000      0.0000 2
C0           -1.6667      2.1082 2 -0.7906  0.5120
C1            0.0000      0.0000 2
B0:C0        -1.3333      2.6667 2 -0.5000  0.6667
B0:C1         0.0000      0.0000 2
B1:C0         0.0000      0.0000 2
B1:C1         0.0000      0.0000 2

```

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

9.9.2 p626

(149) MODEL

```

v2p626 = read.table("C:/G/Rt/Kemp/v2p626.txt", head=TRUE)
v2p626 = af(v2p626, c("A", "B", "C"))
GLM(y ~ A + B + C + A:B, v2p626) # OK

```

\$ANOVA

Response : y

```

      Df Sum Sq Mean Sq F value Pr(>F)
MODEL      4 42.092 10.5231  22.002 0.04395 *
RESIDUALS   2  0.957  0.4783
CORRECTED TOTAL 6 43.049

```

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

\$`Type I`

```

      Df Sum Sq Mean Sq F value Pr(>F)

```

```

A      1 16.2088 16.2088 33.890 0.02826 *
B      1  4.8150  4.8150 10.068 0.08662 .
C      1 15.7339 15.7339 32.898 0.02908 *
A:B    1  5.3346  5.3346 11.154 0.07916 .

```

```
---
```

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

```
$`Type II`
```

```

      Df Sum Sq Mean Sq F value Pr(>F)
A      1 25.4131 25.4131 53.136 0.01830 *
B      1  8.6630  8.6630 18.113 0.05102 .
C      1 19.5193 19.5193 40.812 0.02364 *
A:B    1  5.3346  5.3346 11.154 0.07916 .

```

```
---
```

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

```
$`Type III`
```

```

      Df Sum Sq Mean Sq F value Pr(>F)
A      1 29.7950 29.7950 62.297 0.01568 *
B      1 11.7460 11.7460 24.559 0.03839 *
C      1 19.5193 19.5193 40.812 0.02364 *
A:B    1  5.3346  5.3346 11.154 0.07916 .

```

```
---
```

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

```
$Parameter
```

```

      Estimate Std. Error Df t value Pr(>|t|)
(Intercept) 13.7877     0.56467 2 24.4174 0.001673 **
A0           -6.3427     0.89281 2 -7.1041 0.019244 *
A1            0.0000     0.00000 2
B0            0.9125     0.69157 2  1.3195 0.317812
B1            0.0000     0.00000 2
C0           -3.6073     0.56467 2 -6.3884 0.023637 *
C1            0.0000     0.00000 2
A0:B0         3.7717     1.12933 2  3.3397 0.079156 .
A0:B1         0.0000     0.00000 2
A1:B0         0.0000     0.00000 2
A1:B1         0.0000     0.00000 2

```

```
---
```

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

```
(150) MODEL
```

```
GLM(y ~ A + B + C + A:C, v2p626) # OK
```

```
$ANOVA
```

```
Response : y
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	4	39.229	9.8072	5.1346	0.1696
RESIDUALS	2	3.820	1.9100		
CORRECTED TOTAL	6	43.049			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	16.2088	16.2088	8.4862	0.1004
B	1	4.8150	4.8150	2.5209	0.2533
C	1	15.7339	15.7339	8.2376	0.1030
A:C	1	2.4711	2.4711	1.2937	0.3733

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	25.4131	25.4131	13.3052	0.06762 .
B	1	6.0361	6.0361	3.1602	0.21743
C	1	15.7339	15.7339	8.2376	0.10298
A:C	1	2.4711	2.4711	1.2937	0.37327

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	20.1428	20.1428	10.5459	0.08317 .
B	1	6.0361	6.0361	3.1602	0.21743
C	1	11.8863	11.8863	6.2232	0.13007
A:C	1	2.4711	2.4711	1.2937	0.37327

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	13.4865	1.1284	2	11.9516	0.006928 **
A0	-4.9480	1.3820	2	-3.5802	0.069930 .
A1	0.0000	0.0000	2		
B0	2.0060	1.1284	2	1.7777	0.217428
B1	0.0000	0.0000	2		
C0	-4.0985	1.3820	2	-2.9656	0.097381 .
C1	0.0000	0.0000	2		
A0:C0	2.5670	2.2569	2	1.1374	0.373273
A0:C1	0.0000	0.0000	2		
A1:C0	0.0000	0.0000	2		
A1:C1	0.0000	0.0000	2		

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

(151) MODEL

```
GLM(y ~ A + B + C + B:C, v2p626) # OK
```

```
$ANOVA
```

```
Response : y
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	4	37.340	9.3349	3.2701	0.2477
RESIDUALS	2	5.709	2.8546		
CORRECTED TOTAL	6	43.049			

```
$`Type I`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	16.2088	16.2088	5.6781	0.1400
B	1	4.8150	4.8150	1.6867	0.3236
C	1	15.7339	15.7339	5.5118	0.1434
B:C	1	0.5819	0.5819	0.2038	0.6959

```
$`Type II`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	21.9995	21.9995	7.7067	0.1090
B	1	8.6630	8.6630	3.0347	0.2236
C	1	15.7339	15.7339	5.5118	0.1434
B:C	1	0.5819	0.5819	0.2038	0.6959

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	21.9995	21.9995	7.7067	0.1090
B	1	7.0709	7.0709	2.4770	0.2562
C	1	13.3221	13.3221	4.6669	0.1633
B:C	1	0.5819	0.5819	0.2038	0.6959

```
$Parameter
```

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	12.5333	1.3795	2	9.0853	0.0119 *
A0	-3.8297	1.3795	2	-2.7761	0.1090
A1	0.0000	0.0000	2		
B0	2.7940	1.6896	2	1.6537	0.2400
B1	0.0000	0.0000	2		
C0	-2.3573	2.1812	2	-1.0807	0.3928
C1	0.0000	0.0000	2		
B0:C0	-1.2457	2.7590	2	-0.4515	0.6959
B0:C1	0.0000	0.0000	2		
B1:C0	0.0000	0.0000	2		
B1:C1	0.0000	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

```
v2p642 = read.table("C:/G/Rt/Kemp/v2p642.txt", head=TRUE)
v2p642 = af(v2p642, 2:11)
GLM(Y ~ A + B + C + D + E + F + G, v2p642) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	7	11.0	1.57143	1.6688	0.1646
RESIDUALS	24	22.6	0.94167		
CORRECTED TOTAL	31	33.6			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	5.7800	5.7800	6.1381	0.02066 *
B	1	0.1800	0.1800	0.1912	0.66587
C	1	0.1250	0.1250	0.1327	0.71879
D	1	2.5312	2.5312	2.6881	0.11415
E	1	0.6613	0.6613	0.7022	0.41031
F	1	0.0112	0.0112	0.0119	0.91387
G	1	1.7113	1.7113	1.8173	0.19023

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	5.7800	5.7800	6.1381	0.02066 *
B	1	0.1800	0.1800	0.1912	0.66587
C	1	0.1250	0.1250	0.1327	0.71879
D	1	2.5312	2.5312	2.6881	0.11415
E	1	0.6613	0.6613	0.7022	0.41031
F	1	0.0112	0.0112	0.0119	0.91387
G	1	1.7113	1.7113	1.8173	0.19023

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	5.7800	5.7800	6.1381	0.02066 *
B	1	0.1800	0.1800	0.1912	0.66587
C	1	0.1250	0.1250	0.1327	0.71879
D	1	2.5312	2.5312	2.6881	0.11415

```
E 1 0.6613 0.6613 0.7022 0.41031
F 1 0.0112 0.0112 0.0119 0.91387
G 1 1.7113 1.7113 1.8173 0.19023
```

```
---
```

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

```
$Parameter
```

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	2.2750	0.48520	24	4.6888	9.162e-05 ***
A0	-0.8500	0.34309	24	-2.4775	0.02066 *
A1	0.0000	0.00000	24		
B0	0.1500	0.34309	24	0.4372	0.66587
B1	0.0000	0.00000	24		
C0	-0.1250	0.34309	24	-0.3643	0.71879
C1	0.0000	0.00000	24		
D0	0.5625	0.34309	24	1.6395	0.11415
D1	0.0000	0.00000	24		
E0	-0.2875	0.34309	24	-0.8380	0.41031
E1	0.0000	0.00000	24		
F0	0.0375	0.34309	24	0.1093	0.91387
F1	0.0000	0.00000	24		
G0	0.4625	0.34309	24	1.3481	0.19023
G1	0.0000	0.00000	24		

```
---
```

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

(153) MODEL

```
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	Std. Error	Df	t value	Pr(> t)
(Intercept)	0.2218		0 24	Inf	< 2.2e-16 ***
A0	0.4346		0 24	Inf	< 2.2e-16 ***
A1	0.0000		0 24		
B0	-0.2740		0 24	-Inf	< 2.2e-16 ***
B1	0.0000		0 24		
C0	0.1885		0 24	Inf	< 2.2e-16 ***
C1	0.0000		0 24		
D0	-0.2190		0 24	-Inf	< 2.2e-16 ***
D1	0.0000		0 24		
E0	0.3044		0 24	Inf	< 2.2e-16 ***
E1	0.0000		0 24		
F0	-5.7204		0 24	-Inf	< 2.2e-16 ***
F1	0.0000		0 24		
G0	0.3754		0 24	Inf	< 2.2e-16 ***
G1	0.0000		0 24		

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

9.11 Chapter 19

9.11.1 p700

(154) MODEL

```
v2p700 = read.table("C:/G/Rt/Kemp/v2p700.txt", head=TRUE)
v2p700 = af(v2p700, 2:5)
GLM(Y ~ P + S + T + C, v2p700) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	12	378.80	31.5670	57.256	0.003319 **
RESIDUALS	3	1.65	0.5513		
CORRECTED TOTAL	15	380.46			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
P	3	53.888	17.963	32.580	0.008646 **
S	3	154.508	51.503	93.414	0.001845 **
T	3	149.848	49.949	90.597	0.001930 **
C	3	20.561	6.854	12.431	0.033708 *

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
P	2	2.220	1.110	2.0133	0.278974
S	3	111.966	37.322	67.6941	0.002969 **
T	3	161.828	53.943	97.8403	0.001722 **
C	3	20.561	6.854	12.4311	0.033708 *

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

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
P	2	2.220	1.110	2.0133	0.278974
S	3	111.966	37.322	67.6941	0.002969 **
T	3	161.828	53.943	97.8403	0.001722 **
C	3	20.561	6.854	12.4311	0.033708 *

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

```

$Parameter
      Estimate Std. Error Df t value Pr(>|t|)
(Intercept)  14.675     0.76085 3 19.2875 0.0003044 ***
P1           4.670     0.66413 3  7.0318 0.0059092 **
P2          -0.600     0.52504 3 -1.1428 0.3360714
P3           0.450     0.52504 3  0.8571 0.4544117
P4           0.000     0.00000 3
S1           2.860     0.55067 3  5.1937 0.0138648 *
S2           3.595     0.55067 3  6.5285 0.0073033 **
S3          -3.455     0.55067 3 -6.2742 0.0081740 **
S4           0.000     0.00000 3
T1           5.650     0.55067 3 10.2603 0.0019739 **
T2           6.255     0.55067 3 11.3590 0.0014638 **
T3          -1.285     0.55067 3 -2.3335 0.1018191
T4           0.000     0.00000 3
C0           0.000     0.00000 3
C1           2.800     0.66413 3  4.2161 0.0243844 *
C2           0.620     0.66413 3  0.9336 0.4193997
C3          -1.140     0.66413 3 -1.7165 0.1845672
C4           0.000     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	Std. Error	Df	t value	Pr(> t)
(Intercept)	14.2042	1.02435	6	13.8665	8.759e-06 ***
P1	4.8875	0.96740	6	5.0522	0.0023285 **
P2	-0.7000	0.82500	6	-0.8485	0.4287138
P3	0.3500	0.82500	6	0.4242	0.6861791
P4	-0.1000	0.82500	6	-0.1212	0.9074805
P5	0.0000	0.00000	6		
S1	3.4500	0.75312	6	4.5810	0.0037667 **
S2	3.4250	0.75312	6	4.5478	0.0039011 **
S3	-3.7083	0.75312	6	-4.9240	0.0026462 **
S4	0.0000	0.00000	6		
T1	5.5667	0.75312	6	7.3915	0.0003148 ***
T2	6.4250	0.75312	6	8.5312	0.0001422 ***
T3	-0.5250	0.75312	6	-0.6971	0.5118309
T4	0.0000	0.00000	6		
C1	2.6750	0.82500	6	3.2424	0.0176331 *
C2	0.8750	0.82500	6	1.0606	0.3296846
C3	0.0000	0.82500	6	0.0000	1.0000000
C4	0.0000	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.

```
require(daewr)
```

10.1 Chapter 2

10.1.1 p22

(156) MODEL

```
GLM(height ~ time, bread) # OK
```

\$ANOVA

Response : height

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	2	21.573	10.7865	4.6022	0.042 *
RESIDUALS	9	21.094	2.3438		
CORRECTED TOTAL	11	42.667			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
time	2	21.573	10.787	4.6022	0.042 *

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
time	2	21.573	10.787	4.6022	0.042 *

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
time	2	21.573	10.787	4.6022	0.042 *

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
--	----------	------------	----	---------	----------

```

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

```

10.1.2 p32

(157) MODEL

```
GLM(height^(1 - 1.294869) ~ time, bread) # OK
```

\$ANOVA

```

Response : height^(1 - 1.294869)
      Df    Sum Sq   Mean Sq F value   Pr(>F)
MODEL      2 0.0130560 0.0065280   5.9356 0.02271 *
RESIDUALS    9 0.0098983 0.0010998
CORRECTED TOTAL 11 0.0229544
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type I`

```

      Df    Sum Sq   Mean Sq F value   Pr(>F)
time  2 0.013056 0.006528  5.9356 0.02271 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type II`

```

      Df    Sum Sq   Mean Sq F value   Pr(>F)
time  2 0.013056 0.006528  5.9356 0.02271 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type III`

```

      Df    Sum Sq   Mean Sq F value   Pr(>F)
time  2 0.013056 0.006528  5.9356 0.02271 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$Parameter

```

      Estimate Std. Error Df t value   Pr(>|t|)
(Intercept)  0.53776    0.016582  9 32.4307 1.239e-10 ***
time35        0.07182    0.023450  9  3.0626  0.01351  *
time40        0.00385    0.023450  9  0.1643  0.87315
time45        0.00000    0.000000  9

```

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

10.1.3 p42

(158) MODEL

```
GLM(yield ~ treat, sugarbeet) # OK
```

\$ANOVA

Response : yield

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	3	291.00	97.002	45.9	1.718e-07 ***
RESIDUALS	14	29.59	2.113		
CORRECTED TOTAL	17	320.59			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
treat	3	291	97.002	45.9	1.718e-07 ***

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
treat	3	291	97.002	45.9	1.718e-07 ***

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
treat	3	291	97.002	45.9	1.718e-07 ***

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	48.7	0.65013	14	74.9085	< 2.2e-16 ***
treatA	-10.0	0.97519	14	-10.2544	6.837e-08 ***
treatB	-3.7	0.97519	14	-3.7941	0.001974 **
treatC	0.1	0.91942	14	0.1088	0.914933
treatD	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

```
GLM(CO ~ Eth + Ratio + Eth:Ratio, COdata) # OK
```

\$ANOVA

Response : CO

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	8	1654.0	206.750	40.016	3.861e-06 ***
RESIDUALS	9	46.5	5.167		
CORRECTED TOTAL	17	1700.5			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Eth	2	324	162.0	31.355	8.790e-05 ***
Ratio	2	652	326.0	63.097	5.067e-06 ***
Eth:Ratio	4	678	169.5	32.806	2.240e-05 ***

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Eth	2	324	162.0	31.355	8.790e-05 ***
Ratio	2	652	326.0	63.097	5.067e-06 ***
Eth:Ratio	4	678	169.5	32.806	2.240e-05 ***

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Eth	2	324	162.0	31.355	8.790e-05 ***
Ratio	2	652	326.0	63.097	5.067e-06 ***
Eth:Ratio	4	678	169.5	32.806	2.240e-05 ***

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	59.0	1.6073	9	36.7081	4.094e-11 ***
Eth0.1	8.0	2.2730	9	3.5195	0.0065202 **
Eth0.2	8.5	2.2730	9	3.7395	0.0046291 **
Eth0.3	0.0	0.0000	9		

Ratio14	33.0	2.2730	9	14.5181	1.498e-07	***
Ratio15	17.5	2.2730	9	7.6990	3.003e-05	***
Ratio16	0.0	0.0000	9			
Eth0.1:Ratio14	-36.0	3.2146	9	-11.1991	1.384e-06	***
Eth0.1:Ratio15	-15.0	3.2146	9	-4.6663	0.0011747	**
Eth0.1:Ratio16	0.0	0.0000	9			
Eth0.2:Ratio14	-21.0	3.2146	9	-6.5328	0.0001073	***
Eth0.2:Ratio15	-4.5	3.2146	9	-1.3999	0.1950620	
Eth0.2:Ratio16	0.0	0.0000	9			
Eth0.3:Ratio14	0.0	0.0000	9			
Eth0.3:Ratio15	0.0	0.0000	9			
Eth0.3:Ratio16	0.0	0.0000	9			

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

(160) MODEL

```
GLM(CO ~ Ratio + Eth + Ratio:Eth, COdata) # OK
```

\$ANOVA

Response : CO

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	8	1654.0	206.750	40.016	3.861e-06 ***
RESIDUALS	9	46.5	5.167		
CORRECTED TOTAL	17	1700.5			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Ratio	2	652	326.0	63.097	5.067e-06 ***
Eth	2	324	162.0	31.355	8.790e-05 ***
Ratio:Eth	4	678	169.5	32.806	2.240e-05 ***

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Ratio	2	652	326.0	63.097	5.067e-06 ***
Eth	2	324	162.0	31.355	8.790e-05 ***
Ratio:Eth	4	678	169.5	32.806	2.240e-05 ***

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Ratio	2	652	326.0	63.097	5.067e-06 ***


```

Eth          2      324    162.0   31.355 8.790e-05 ***
Ratio:Eth    4      678    169.5   32.806 2.240e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$Parameter
      Estimate Std. Error Df   t value   Pr(>|t|)
(Intercept)    59.0      1.6073  9  36.7081 4.094e-11 ***
Ratio14         33.0      2.2730  9  14.5181 1.498e-07 ***
Ratio15         17.5      2.2730  9   7.6990 3.003e-05 ***
Ratio16          0.0      0.0000  9
Eth0.1           8.0      2.2730  9   3.5195 0.0065202 **
Eth0.2           8.5      2.2730  9   3.7395 0.0046291 **
Eth0.3           0.0      0.0000  9
Ratio14:Eth0.1  -36.0      3.2146  9 -11.1991 1.384e-06 ***
Ratio14:Eth0.2  -21.0      3.2146  9  -6.5328 0.0001073 ***
Ratio14:Eth0.3   0.0      0.0000  9
Ratio15:Eth0.1  -15.0      3.2146  9  -4.6663 0.0011747 **
Ratio15:Eth0.2   -4.5      3.2146  9  -1.3999 0.1950620
Ratio15:Eth0.3   0.0      0.0000  9
Ratio16:Eth0.1   0.0      0.0000  9
Ratio16:Eth0.2   0.0      0.0000  9
Ratio16:Eth0.3   0.0      0.0000  9
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

10.2.2 p74

(161) MODEL

```
GLM(CO ~ Eth + Ratio + Eth:Ratio, COdata[-18,]) # OK
```

```

$ANOVA
Response : CO
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      8 1423.0  177.879   31.978 2.749e-05 ***
RESIDUALS   8   44.5    5.563
CORRECTED TOTAL 16 1467.5
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
Eth      2 472.66   236.33   42.486 5.482e-05 ***
Ratio    2 395.33   197.66   35.535 0.0001048 ***
Eth:Ratio 4 555.04   138.76   24.945 0.0001427 ***

```

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

```
$`Type II`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Eth	2	398.26	199.13	35.799	0.0001020 ***
Ratio	2	395.33	197.66	35.535	0.0001048 ***
Eth:Ratio	4	555.04	138.76	24.945	0.0001427 ***

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

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Eth	2	319.45	159.73	28.715	0.0002235 ***
Ratio	2	511.45	255.73	45.973	4.105e-05 ***
Eth:Ratio	4	555.04	138.76	24.945	0.0001427 ***

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

```
$Parameter
```

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	60.0	2.3585	8	25.4399	6.108e-09 ***
Eth0.1	7.0	2.8886	8	2.4234	0.0416315 *
Eth0.2	7.5	2.8886	8	2.5965	0.0317925 *
Eth0.3	0.0	0.0000	8		
Ratio14	32.0	2.8886	8	11.0782	3.933e-06 ***
Ratio15	16.5	2.8886	8	5.7122	0.0004480 ***
Ratio16	0.0	0.0000	8		
Eth0.1:Ratio14	-35.0	3.7291	8	-9.3856	1.360e-05 ***
Eth0.1:Ratio15	-14.0	3.7291	8	-3.7542	0.0055901 **
Eth0.1:Ratio16	0.0	0.0000	8		
Eth0.2:Ratio14	-20.0	3.7291	8	-5.3632	0.0006751 ***
Eth0.2:Ratio15	-3.5	3.7291	8	-0.9386	0.3754235
Eth0.2:Ratio16	0.0	0.0000	8		
Eth0.3:Ratio14	0.0	0.0000	8		
Eth0.3:Ratio15	0.0	0.0000	8		
Eth0.3:Ratio16	0.0	0.0000	8		

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

10.2.3 p91

(162) MODEL

```
volt$XA = (as.numeric(as.character(volt$A)) - 27)/5
volt$XB = (as.numeric(as.character(volt$B)) - 2.75)/2.25
```

```
volt$XC = (as.numeric(as.character(volt$C)) - 2.75)/2.25
GLM(y ~ XA + XB + XC + XA:XB + XA:XC + XB:XC + XA:XB:XC, volt) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	7	8843.4	1263.35	3.8686	0.0385 *
RESIDUALS	8	2612.5	326.56		
CORRECTED TOTAL	15	11455.9			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
XA	1	4522.6	4522.6	13.8490	0.005859 **
XB	1	14.1	14.1	0.0431	0.840793
XC	1	473.1	473.1	1.4486	0.263154
XA:XB	1	715.6	715.6	2.1912	0.177071
XA:XC	1	2525.1	2525.1	7.7322	0.023899 *
XB:XC	1	52.6	52.6	0.1610	0.698780
XA:XB:XC	1	540.6	540.6	1.6553	0.234218

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
XA	1	4522.6	4522.6	13.8490	0.005859 **
XB	1	14.1	14.1	0.0431	0.840793
XC	1	473.1	473.1	1.4486	0.263154
XA:XB	1	715.6	715.6	2.1912	0.177071
XA:XC	1	2525.1	2525.1	7.7322	0.023899 *
XB:XC	1	52.6	52.6	0.1610	0.698780
XA:XB:XC	1	540.6	540.6	1.6553	0.234218

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
XA	1	4522.6	4522.6	13.8490	0.005859 **
XB	1	14.1	14.1	0.0431	0.840793
XC	1	473.1	473.1	1.4486	0.263154
XA:XB	1	715.6	715.6	2.1912	0.177071
XA:XC	1	2525.1	2525.1	7.7322	0.023899 *
XB:XC	1	52.6	52.6	0.1610	0.698780
XA:XB:XC	1	540.6	540.6	1.6553	0.234218

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

```

$Parameter
      Estimate Std. Error 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	Std. Error	Df	t value	Pr(> t)
(Intercept)	93		0		
A-1	4		0		
A1	0		0		
B-1	-45		0		
B1	0		0		
A1:B1	-19		0		
A1:B-1	0		0		
A-1:B1	0		0		
A-1:B-1	0		0		
C-1	-5		0		

C1	0	0
A1:C1	-7	0
A1:C-1	0	0
A-1:C1	0	0
A-1:C-1	0	0
B1:C1	0	0
B1:C-1	0	0
B-1:C1	0	0
B-1:C-1	0	0
A1:B1:C1	1	0
A1:B1:C-1	0	0
A1:B-1:C1	0	0
A1:B-1:C-1	0	0
A-1:B1:C1	0	0
A-1:B1:C-1	0	0
A-1:B-1:C1	0	0
A-1:B-1:C-1	0	0
D-1	-2	0
D1	0	0
A1:D1	0	0
A1:D-1	0	0
A-1:D1	0	0
A-1:D-1	0	0
B1:D1	3	0
B1:D-1	0	0
B-1:D1	0	0
B-1:D-1	0	0
A1:B1:D1	-3	0
A1:B1:D-1	0	0
A1:B-1:D1	0	0
A1:B-1:D-1	0	0
A-1:B1:D1	0	0
A-1:B1:D-1	0	0
A-1:B-1:D1	0	0
A-1:B-1:D-1	0	0
C1:D1	-12	0
C1:D-1	0	0
C-1:D1	0	0
C-1:D-1	0	0
A1:C1:D1	22	0
A1:C1:D-1	0	0
A1:C-1:D1	0	0
A1:C-1:D-1	0	0
A-1:C1:D1	0	0
A-1:C1:D-1	0	0
A-1:C-1:D1	0	0
A-1:C-1:D-1	0	0
B1:C1:D1	-1	0

B1:C1:D-1	0	0
B1:C-1:D1	0	0
B1:C-1:D-1	0	0
B-1:C1:D1	0	0
B-1:C1:D-1	0	0
B-1:C-1:D1	0	0
B-1:C-1:D-1	0	0
A1:B1:C1:D1	-5	0
A1:B1:C1:D-1	0	0
A1:B1:C-1:D1	0	0
A1:B1:C-1:D-1	0	0
A1:B-1:C1:D1	0	0
A1:B-1:C1:D-1	0	0
A1:B-1:C-1:D1	0	0
A1:B-1:C-1:D-1	0	0
A-1:B1:C1:D1	0	0
A-1:B1:C1:D-1	0	0
A-1:B1:C-1:D1	0	0
A-1:B1:C-1:D-1	0	0
A-1:B-1:C1:D1	0	0
A-1:B-1:C1:D-1	0	0
A-1:B-1:C-1:D1	0	0
A-1:B-1:C-1:D-1	0	0

10.2.5 p104

(164) MODEL

```
GLM(y ~ A*B*C*D, BoxM) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	15	207.1	13.807		
RESIDUALS	0	0.0			
CORRECTED TOTAL	15	207.1			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	2.560	2.560		
B	1	71.234	71.234		
A:B	1	3.312	3.312		
C	1	55.056	55.056		
A:C	1	24.800	24.800		
B:C	1	2.560	2.560		
A:B:C	1	5.760	5.760		

D	1	4.080	4.080
A:D	1	1.346	1.346
B:D	1	5.570	5.570
A:B:D	1	2.074	2.074
C:D	1	8.880	8.880
A:C:D	1	0.640	0.640
B:C:D	1	9.986	9.986
A:B:C:D	1	9.242	9.242

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	2.560	2.560		
B	1	71.234	71.234		
A:B	1	3.312	3.312		
C	1	55.056	55.056		
A:C	1	24.800	24.800		
B:C	1	2.560	2.560		
A:B:C	1	5.760	5.760		
D	1	4.080	4.080		
A:D	1	1.346	1.346		
B:D	1	5.570	5.570		
A:B:D	1	2.074	2.074		
C:D	1	8.880	8.880		
A:C:D	1	0.640	0.640		
B:C:D	1	9.986	9.986		
A:B:C:D	1	9.242	9.242		

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	2.560	2.560		
B	1	71.234	71.234		
A:B	1	3.312	3.312		
C	1	55.056	55.056		
A:C	1	24.800	24.800		
B:C	1	2.560	2.560		
A:B:C	1	5.760	5.760		
D	1	4.080	4.080		
A:D	1	1.346	1.346		
B:D	1	5.570	5.570		
A:B:D	1	2.074	2.074		
C:D	1	8.880	8.880		
A:C:D	1	0.640	0.640		
B:C:D	1	9.986	9.986		
A:B:C:D	1	9.242	9.242		

\$Parameter

	Estimate	Std. Error	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

```
GLM(rate ~ rat + dose, drug) # OK
```

\$ANOVA

Response : rate

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	13	2.12867	0.163744	19.613	1.59e-12 ***
RESIDUALS	36	0.30055	0.008349		
CORRECTED TOTAL	49	2.42922			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rat	9	1.66846	0.18538	22.205	3.749e-12 ***
dose	4	0.46021	0.11505	13.781	6.535e-07 ***

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rat	9	1.66846	0.18538	22.205	3.749e-12 ***
dose	4	0.46021	0.11505	13.781	6.535e-07 ***

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

```
$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
rat     9 1.66846  0.18538   22.205 3.749e-12 ***
dose    4 0.46021  0.11505   13.781 6.535e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
      Estimate Std. Error Df t value Pr(>|t|)
(Intercept)   1.0578    0.048349 36 21.8784 < 2.2e-16 ***
rat1          -0.4160    0.057788 36 -7.1987 1.804e-08 ***
rat2          -0.4300    0.057788 36 -7.4410 8.740e-09 ***
rat3          -0.4040    0.057788 36 -6.9911 3.373e-08 ***
rat4          -0.3000    0.057788 36 -5.1914 8.362e-06 ***
rat5          -0.1340    0.057788 36 -2.3188 0.0261960 *
rat6          -0.2880    0.057788 36 -4.9837 1.579e-05 ***
rat7          -0.2140    0.057788 36 -3.7032 0.0007098 ***
rat8           0.0240    0.057788 36  0.4153 0.6803798
rat9           0.0840    0.057788 36  1.4536 0.1547238
rat10          0.0000    0.000000 36
dose0         -0.0860    0.040862 36 -2.1046 0.0423697 *
dose0.5        0.0840    0.040862 36  2.0557 0.0471211 *
dose1          0.1640    0.040862 36  4.0135 0.0002899 ***
dose1.5        0.1590    0.040862 36  3.8911 0.0004137 ***
dose2          0.0000    0.000000 36
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

10.3.2 p127

(166) MODEL

```
GLM(y ~ block + treat + strain + treat:strain, bha) # OK
```

```
$ANOVA
Response : y
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      8 543.22   67.902   26.203 0.0001507 ***
RESIDUALS   7  18.14    2.591
CORRECTED TOTAL 15 561.36
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

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

```

block      1  47.61   47.61  18.3721  0.003627 **
treat      1 422.30  422.30 162.9613 4.194e-06 ***
strain     3  32.96   10.99   4.2399  0.052741 .
treat:strain 3  40.34   13.45   5.1892  0.033685 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type II`

```

      Df Sum Sq Mean Sq F value    Pr(>F)
block      1  47.61   47.61  18.3721  0.003627 **
treat      1 422.30  422.30 162.9613 4.194e-06 ***
strain     3  32.96   10.99   4.2399  0.052741 .
treat:strain 3  40.34   13.45   5.1892  0.033685 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type III`

```

      Df Sum Sq Mean Sq F value    Pr(>F)
block      1  47.61   47.61  18.3721  0.003627 **
treat      1 422.30  422.30 162.9613 4.194e-06 ***
strain     3  32.96   10.99   4.2399  0.052741 .
treat:strain 3  40.34   13.45   5.1892  0.033685 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$Parameter

```

              Estimate Std. Error Df t value Pr(>|t|)
(Intercept)      13.875      1.2073  7 11.4922 8.495e-06 ***
block1              3.450      0.8049  7  4.2863  0.003627 **
block2              0.000      0.0000  7
treatcontrol     -15.200      1.6098  7 -9.4422 3.119e-05 ***
treattreated       0.000      0.0000  7
strain1290la       0.550      1.6098  7  0.3417  0.742635
strainA/J          2.100      1.6098  7  1.3045  0.233308
strainBALB/c       7.450      1.6098  7  4.6279  0.002404 **
strainNIH          0.000      0.0000  7
treatcontrol:strainA/J  4.550      2.2766  7  1.9986  0.085796 .
treatcontrol:strainNIH  8.550      2.2766  7  3.7556  0.007116 **
treatcontrol:strain1290la 6.600      2.2766  7  2.8991  0.023016 *
treatcontrol:strainBALB/c 0.000      0.0000  7
treattreated:strainA/J  0.000      0.0000  7
treattreated:strainNIH  0.000      0.0000  7
treattreated:strain1290la 0.000      0.0000  7
treattreated:strainBALB/c 0.000      0.0000  7
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

10.3.3 p129

(167) MODEL

```
GLM(cdistance ~ id + teehgt, rcb) # OK
```

\$ANOVA

Response : cdistance

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	10	126465	12646.5	161.72	< 2.2e-16 ***
RESIDUALS	124	9697	78.2		
CORRECTED TOTAL	134	136162			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
id	8	124741	15593	199.394	< 2.2e-16 ***
teehgt	2	1724	862	11.023	3.926e-05 ***

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
id	8	124741	15593	199.394	< 2.2e-16 ***
teehgt	2	1724	862	11.023	3.926e-05 ***

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
id	8	124741	15593	199.394	< 2.2e-16 ***
teehgt	2	1724	862	11.023	3.926e-05 ***

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	240.440	2.5243	124	95.2517	< 2.2e-16 ***
id1	-92.907	3.2290	124	-28.7722	< 2.2e-16 ***
id2	-57.860	3.2290	124	-17.9186	< 2.2e-16 ***
id3	-92.907	3.2290	124	-28.7722	< 2.2e-16 ***
id4	-60.360	3.2290	124	-18.6928	< 2.2e-16 ***
id5	-22.267	3.2290	124	-6.8957	2.422e-10 ***
id6	-92.860	3.2290	124	-28.7577	< 2.2e-16 ***
id7	-66.720	3.2290	124	-20.6625	< 2.2e-16 ***
id8	-59.540	3.2290	124	-18.4389	< 2.2e-16 ***

```

id9          0.000      0.0000 124
teehgt1      -8.380      1.8643 124  -4.4950 1.575e-05 ***
teehgt2      -2.000      1.8643 124  -1.0728  0.2854
teehgt3       0.000      0.0000 124
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

10.3.4 p136

(168) MODEL

```
GLM(AUC ~ Subject + Period + Treat, bioeqv) # OK
```

\$ANOVA

Response : AUC

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	6	174461	29077	0.1315	0.9774
RESIDUALS	2	442158	221079		
CORRECTED TOTAL	8	616618			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	2	114264	57132	0.2584	0.7946
Period	2	45196	22598	0.1022	0.9073
Treat	2	15000	7500	0.0339	0.9672

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	2	114264	57132	0.2584	0.7946
Period	2	45196	22598	0.1022	0.9073
Treat	2	15000	7500	0.0339	0.9672

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	2	114264	57132	0.2584	0.7946
Period	2	45196	22598	0.1022	0.9073
Treat	2	15000	7500	0.0339	0.9672

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	1352.56	414.67	2	3.2618	0.08252 .
Subject1	-276.00	383.91	2	-0.7189	0.54684
Subject2	-138.33	383.91	2	-0.3603	0.75310
Subject3	0.00	0.00	2		
Period1	-171.00	383.91	2	-0.4454	0.69959
Period2	-111.33	383.91	2	-0.2900	0.79912

```

Period3      0.00      0.00  2
TreatA       78.33     383.91  2  0.2040  0.85720
TreatB      -14.67     383.91  2 -0.0382  0.97300
TreatC       0.00      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

```
GLM(conc ~ lab, Apo) # OK
```

```

$ANOVA
Response : conc
      Df  Sum Sq  Mean Sq F value    Pr(>F)
MODEL      3 0.092233 0.0307444  42.107 4.009e-10 ***
RESIDUALS  26 0.018984 0.0007302
CORRECTED TOTAL 29 0.111217
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type I`
      Df  Sum Sq  Mean Sq F value    Pr(>F)
lab    3 0.092233 0.030744  42.107 4.009e-10 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type II`
      Df  Sum Sq  Mean Sq F value    Pr(>F)
lab    3 0.092233 0.030744  42.107 4.009e-10 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type III`
      Df  Sum Sq  Mean Sq F value    Pr(>F)
lab    3 0.092233 0.030744  42.107 4.009e-10 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$Parameter
      Estimate Std. Error Df  t value  Pr(>|t|)
(Intercept)  1.16425   0.0095535 26 121.8661 < 2.2e-16 ***
labA         0.02661   0.0139849 26   1.9026  0.06823 .

```

```

labB      -0.00237  0.0135107 26  -0.1758   0.86182
labC      -0.12111  0.0139849 26  -8.6598  3.878e-09 ***
labD       0.00000  0.0000000 26
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

10.4.2 p181

(170) MODEL

```
GLM(residue ~ form + tech + form:tech + plot:form:tech, pesticide) # OK
```

```

$ANOVA
Response : residue
      Df Sum Sq Mean Sq F value Pr(>F)
MODEL      7 0.036857 0.0052653  11.804 0.001187 **
RESIDUALS   8 0.003569 0.0004461
CORRECTED TOTAL 15 0.040426
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type I`
      Df Sum Sq Mean Sq F value Pr(>F)
form      1 0.000018 0.000018  0.0405  0.84554
tech      1 0.032310 0.032310 72.4339 2.789e-05 ***
form:tech  1 0.002186 0.002186  4.8997  0.05776 .
form:tech:plot 4 0.002344 0.000586  1.3136  0.34317
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type II`
      Df Sum Sq Mean Sq F value Pr(>F)
form      1 0.000018 0.000018  0.0405  0.84554
tech      1 0.032310 0.032310 72.4339 2.789e-05 ***
form:tech  1 0.002186 0.002186  4.8997  0.05776 .
form:tech:plot 4 0.002344 0.000586  1.3136  0.34317
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type III`
      Df Sum Sq Mean Sq F value Pr(>F)
form      1 0.000018 0.000018  0.0405  0.84554
tech      1 0.032310 0.032310 72.4339 2.789e-05 ***
form:tech  1 0.002186 0.002186  4.8997  0.05776 .
form:tech:plot 4 0.002344 0.000586  1.3136  0.34317
---

```

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	0.3410	0.014934	8	22.8334	1.435e-08 ***
formA	0.0225	0.021120	8	1.0653	0.31782
formB	0.0000	0.000000	8		
tech1	-0.0470	0.021120	8	-2.2254	0.05671 .
tech2	0.0000	0.000000	8		
formA:tech1	-0.0390	0.029868	8	-1.3057	0.22794
formA:tech2	0.0000	0.000000	8		
formB:tech1	0.0000	0.000000	8		
formB:tech2	0.0000	0.000000	8		
formA:tech1:plot1	-0.0330	0.021120	8	-1.5625	0.15680
formA:tech1:plot2	0.0000	0.000000	8		
formA:tech2:plot1	0.0215	0.021120	8	1.0180	0.33848
formA:tech2:plot2	0.0000	0.000000	8		
formB:tech1:plot1	-0.0235	0.021120	8	-1.1127	0.29816
formB:tech1:plot2	0.0000	0.000000	8		
formB:tech2:plot1	0.0155	0.021120	8	0.7339	0.48396
formB:tech2:plot2	0.0000	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

```
GLM(score ~ recipe + panelist, taste) # OK
```

\$ANOVA

Response : score

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	14	28.458	2.03274	2.661	0.0719 .
RESIDUALS	9	6.875	0.76389		
CORRECTED TOTAL	23	35.333			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
recipe	3	21.0000	7.000	9.1636	0.004246 **
panelist	11	7.4583	0.678	0.8876	0.581099

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

```
$`Type II`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
recipe	3	9.1250	3.04167	3.9818	0.04649 *
panelist 11	7.4583	0.67803	0.8876	0.58110	

```
---
```

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

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
recipe	3	9.1250	3.04167	3.9818	0.04649 *
panelist 11	7.4583	0.67803	0.8876	0.58110	

```
---
```

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

```
$Parameter
```

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	4.5000	0.69096	9	6.5126	0.0001098 ***
recipeA	0.6250	0.61802	9	1.0113	0.3382874
recipeB	1.3750	0.61802	9	2.2249	0.0531409 .
recipeC	2.0000	0.61802	9	3.2362	0.0102213 *
recipeD	0.0000	0.00000	9		
panelist1	-0.5000	0.97717	9	-0.5117	0.6211912
panelist2	0.6875	0.92702	9	0.7416	0.4772232
panelist3	-0.3125	0.92702	9	-0.3371	0.7437697
panelist4	0.3125	0.92702	9	0.3371	0.7437697
panelist5	-0.1875	0.92702	9	-0.2023	0.8442116
panelist6	1.5000	0.87401	9	1.7162	0.1202534
panelist7	1.0000	0.97717	9	1.0234	0.3328547
panelist8	0.6875	0.92702	9	0.7416	0.4772232
panelist9	-0.3125	0.92702	9	-0.3371	0.7437697
panelist10	0.8125	0.92702	9	0.8765	0.4035670
panelist11	0.3125	0.92702	9	0.3371	0.7437697
panelist12	0.0000	0.00000	9		

```
---
```

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

10.5.2 p262

(172) MODEL

```
GLM(pressure ~ Block + Treatment, BPmonitor) # OK
```

```
$ANOVA
```

```
Response : pressure
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	8	321.00	40.125	4.4174	0.1245
RESIDUALS	3	27.25	9.083		
CORRECTED TOTAL	11	348.25			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Block	5	73.75	14.750	1.6239	0.36606
Treatment	3	247.25	82.417	9.0734	0.05149 .

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Block	5	83.25	16.650	1.8330	0.32772
Treatment	3	247.25	82.417	9.0734	0.05149 .

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Block	5	83.25	16.650	1.8330	0.32772
Treatment	3	247.25	82.417	9.0734	0.05149 .

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	78.00	2.6101	3	29.8842	8.23e-05 ***
Block1	6.25	3.6912	3	1.6932	0.18899
Block2	2.75	3.6912	3	0.7450	0.51032
Block3	9.50	3.6912	3	2.5737	0.08223 .
Block4	3.50	3.6912	3	0.9482	0.41298
Block5	2.00	3.0139	3	0.6636	0.55439
Block6	0.00	0.0000	3		
TreatmentA	-6.50	3.0139	3	-2.1567	0.11995
TreatmentB	-13.00	3.0139	3	-4.3134	0.02295 *
TreatmentC	-6.00	3.0139	3	-1.9908	0.14057
TreatmentP	0.00	0.0000	3		

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

10.5.3 p276

(173) MODEL

```
GLM(weight ~ Blocks + A + B + C + D + E + F + G + H, Bff) # OK
```

```
$ANOVA
```

```
Response : weight
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	15	158.37	10.558		
RESIDUALS	0	0.00			
CORRECTED TOTAL	15	158.37			

```
$`Type I`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Blocks	7	30.567	4.367		
A	1	21.879	21.879		
B	1	8.338	8.338		
C	1	6.213	6.213		
D	1	12.870	12.870		
E	1	0.098	0.098		
F	1	1.260	1.260		
G	1	71.868	71.868		
H	1	5.279	5.279		

```
$`Type II`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Blocks	7	30.567	4.367		
A	1	21.879	21.879		
B	1	8.338	8.338		
C	1	6.213	6.213		
D	1	12.870	12.870		
E	1	0.098	0.098		
F	1	1.260	1.260		
G	1	71.868	71.868		
H	1	5.279	5.279		

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Blocks	7	30.567	4.367		
A	1	21.879	21.879		
B	1	8.338	8.338		
C	1	6.213	6.213		
D	1	12.870	12.870		
E	1	0.098	0.098		
F	1	1.260	1.260		
G	1	71.868	71.868		
H	1	5.279	5.279		

```
$Parameter
```

	Estimate	Std. Error	Df	t value	Pr(> t)
--	----------	------------	----	---------	----------

(Intercept)	10.2000	0
Blocks1	-3.0350	0
Blocks2	0.0900	0
Blocks3	-0.9600	0
Blocks4	-2.1700	0
Blocks5	-0.4600	0
Blocks6	-2.5200	0
Blocks7	-3.8200	0
Blocks8	0.0000	0
A-1	-2.3388	0
A1	0.0000	0
B-1	1.4437	0
B1	0.0000	0
C-1	-1.2463	0
C1	0.0000	0
D-1	1.7937	0
D1	0.0000	0
E-1	-0.1563	0
E1	0.0000	0
F-1	0.5612	0
F1	0.0000	0
G-1	-4.2388	0
G1	0.0000	0
H-1	-1.1488	0
H1	0.0000	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	Std. Error	Df	t value	Pr(> t)
(Intercept)	2.00875	0.040497	12	49.6029	3.109e-15 ***
Block1	0.02750	0.010921	12	2.5181	0.027005 *
Block2	0.00000	0.000000	12		
A-1	0.03500	0.017268	12	2.0269	0.065486 .
A1	0.00000	0.000000	12		
B-1	0.01250	0.017268	12	0.7239	0.483007
B1	0.00000	0.000000	12		
A1:B1	-0.00625	0.024420	12	-0.2559	0.802336
A1:B-1	0.00000	0.000000	12		
A-1:B1	0.00000	0.000000	12		
A-1:B-1	0.00000	0.000000	12		
Block1:A1:B1	-0.05250	0.015445	12	-3.3992	0.005277 **
Block1:A1:B-1	-0.03000	0.015445	12	-1.9424	0.075926 .
Block1:A-1:B1	0.01500	0.015445	12	0.9712	0.350618
Block1:A-1:B-1	0.00000	0.000000	12		
Block2:A1:B1	0.00000	0.000000	12		
Block2:A1:B-1	0.00000	0.000000	12		
Block2:A-1:B1	0.00000	0.000000	12		
Block2:A-1:B-1	0.00000	0.000000	12		
C-1	0.01500	0.015445	12	0.9712	0.350618
C1	0.00000	0.000000	12		
D-1	-0.01000	0.015445	12	-0.6475	0.529522
D1	0.00000	0.000000	12		
C1:D1	0.01500	0.021842	12	0.6867	0.505299
C1:D-1	0.00000	0.000000	12		
C-1:D1	0.00000	0.000000	12		
C-1:D-1	0.00000	0.000000	12		
A1:C1	-0.03500	0.021842	12	-1.6024	0.135048
A1:C-1	0.00000	0.000000	12		
A-1:C1	0.00000	0.000000	12		

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

```

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

```

10.6.2 p320

(175) MODEL

```
GLM(y ~ A*B*C*D*E, plasma) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	31	6672.9	215.26		
RESIDUALS	0	0.0			
CORRECTED TOTAL	31	6672.9			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	1118.65	1118.65		
B	1	142.81	142.81		
A:B	1	141.96	141.96		
C	1	91.80	91.80		
A:C	1	70.81	70.81		
B:C	1	5.78	5.78		
A:B:C	1	65.55	65.55		
D	1	1824.08	1824.08		
A:D	1	2194.53	2194.53		
B:D	1	87.78	87.78		
A:B:D	1	87.12	87.12		
C:D	1	22.45	22.45		
A:C:D	1	42.78	42.78		
B:C:D	1	12.25	12.25		
A:B:C:D	1	375.38	375.38		

E	1	78.75	78.75
A:E	1	278.48	278.48
B:E	1	0.72	0.72
A:B:E	1	0.10	0.10
C:E	1	0.15	0.15
A:C:E	1	0.24	0.24
B:C:E	1	6.48	6.48
A:B:C:E	1	1.53	1.53
D:E	1	8.40	8.40
A:D:E	1	5.28	5.28
B:D:E	1	0.28	0.28
A:B:D:E	1	0.60	0.60
C:D:E	1	0.85	0.85
A:C:D:E	1	0.55	0.55
B:C:D:E	1	6.30	6.30
A:B:C:D:E	1	0.50	0.50

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	1118.65	1118.65		
B	1	142.81	142.81		
A:B	1	141.96	141.96		
C	1	91.80	91.80		
A:C	1	70.81	70.81		
B:C	1	5.78	5.78		
A:B:C	1	65.55	65.55		
D	1	1824.08	1824.08		
A:D	1	2194.53	2194.53		
B:D	1	87.78	87.78		
A:B:D	1	87.12	87.12		
C:D	1	22.45	22.45		
A:C:D	1	42.78	42.78		
B:C:D	1	12.25	12.25		
A:B:C:D	1	375.38	375.38		
E	1	78.75	78.75		
A:E	1	278.48	278.48		
B:E	1	0.72	0.72		
A:B:E	1	0.10	0.10		
C:E	1	0.15	0.15		
A:C:E	1	0.24	0.24		
B:C:E	1	6.48	6.48		
A:B:C:E	1	1.53	1.53		
D:E	1	8.40	8.40		
A:D:E	1	5.28	5.28		
B:D:E	1	0.28	0.28		
A:B:D:E	1	0.60	0.60		
C:D:E	1	0.85	0.85		
A:C:D:E	1	0.55	0.55		

B:C:D:E	1	6.30	6.30
A:B:C:D:E	1	0.50	0.50

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	1118.64	1118.64		
B	1	142.80	142.80		
A:B	1	141.96	141.96		
C	1	91.80	91.80		
A:C	1	70.81	70.81		
B:C	1	5.78	5.78		
A:B:C	1	65.55	65.55		
D	1	1824.08	1824.08		
A:D	1	2194.53	2194.53		
B:D	1	87.78	87.78		
A:B:D	1	87.12	87.12		
C:D	1	22.45	22.45		
A:C:D	1	42.78	42.78		
B:C:D	1	12.25	12.25		
A:B:C:D	1	375.38	375.38		
E	1	78.75	78.75		
A:E	1	278.48	278.48		
B:E	1	0.72	0.72		
A:B:E	1	0.10	0.10		
C:E	1	0.15	0.15		
A:C:E	1	0.24	0.24		
B:C:E	1	6.48	6.48		
A:B:C:E	1	1.53	1.53		
D:E	1	8.40	8.40		
A:D:E	1	5.28	5.28		
B:D:E	1	0.28	0.28		
A:B:D:E	1	0.60	0.60		
C:D:E	1	0.85	0.85		
A:C:D:E	1	0.55	0.55		
B:C:D:E	1	6.30	6.30		
A:B:C:D:E	1	0.50	0.50		

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	48.2		0		
A-	-24.3		0		
A+	0.0		0		
B-	-5.0		0		
B+	0.0		0		
A-:B-	4.8		0		
A-:B+	0.0		0		
A+:B-	0.0		0		
A+:B+	0.0		0		

C-	-10.4	0
C+	0.0	0
A-:C-	19.5	0
A-:C+	0.0	0
A+:C-	0.0	0
A+:C+	0.0	0
B-:C-	23.4	0
B-:C+	0.0	0
B+:C-	0.0	0
B+:C+	0.0	0
A-:B-:C-	-38.1	0
A-:B-:C+	0.0	0
A-:B+:C-	0.0	0
A-:B+:C+	0.0	0
A+:B-:C-	0.0	0
A+:B-:C+	0.0	0
A+:B+:C-	0.0	0
A+:B+:C+	0.0	0
D-	-3.8	0
D+	0.0	0
A-:D-	34.5	0
A-:D+	0.0	0
A+:D-	0.0	0
A+:D+	0.0	0
B-:D-	5.4	0
B-:D+	0.0	0
B+:D-	0.0	0
B+:D+	0.0	0
A-:B-:D-	-16.3	0
A-:B-:D+	0.0	0
A-:B+:D-	0.0	0
A-:B+:D+	0.0	0
A+:B-:D-	0.0	0
A+:B-:D+	0.0	0
A+:B+:D-	0.0	0
A+:B+:D+	0.0	0
C-:D-	17.3	0
C-:D+	0.0	0
C+:D-	0.0	0
C+:D+	0.0	0
A-:C-:D-	-18.1	0
A-:C-:D+	0.0	0
A-:C+:D-	0.0	0
A-:C+:D+	0.0	0
A+:C-:D-	0.0	0
A+:C-:D+	0.0	0
A+:C+:D-	0.0	0
A+:C+:D+	0.0	0

B-:C-:D-	-36.9	0
B-:C-:D+	0.0	0
B-:C+:D-	0.0	0
B-:C+:D+	0.0	0
B+:C-:D-	0.0	0
B+:C-:D+	0.0	0
B+:C+:D-	0.0	0
B+:C+:D+	0.0	0
A-:B-:C-:D-	56.8	0
A-:B-:C-:D+	0.0	0
A-:B-:C+:D-	0.0	0
A-:B-:C+:D+	0.0	0
A-:B+:C-:D-	0.0	0
A-:B+:C-:D+	0.0	0
A-:B+:C+:D-	0.0	0
A-:B+:C+:D+	0.0	0
A+:B-:C-:D-	0.0	0
A+:B-:C-:D+	0.0	0
A+:B-:C+:D-	0.0	0
A+:B-:C+:D+	0.0	0
A+:B+:C-:D-	0.0	0
A+:B+:C-:D+	0.0	0
A+:B+:C+:D-	0.0	0
A+:B+:C+:D+	0.0	0
E-	1.3	0
E+	0.0	0
A-:E-	-13.9	0
A-:E+	0.0	0
A+:E-	0.0	0
A+:E+	0.0	0
B-:E-	3.0	0
B-:E+	0.0	0
B+:E-	0.0	0
B+:E+	0.0	0
A-:B-:E-	-0.8	0
A-:B-:E+	0.0	0
A-:B+:E-	0.0	0
A-:B+:E+	0.0	0
A+:B-:E-	0.0	0
A+:B-:E+	0.0	0
A+:B+:E-	0.0	0
A+:B+:E+	0.0	0
C-:E-	2.7	0
C-:E+	0.0	0
C+:E-	0.0	0
C+:E+	0.0	0
A-:C-:E-	2.5	0
A-:C-:E+	0.0	0

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

B+:D+:E-	0.0	0
B+:D+:E+	0.0	0
A-:B-:D-:E-	4.2	0
A-:B-:D-:E+	0.0	0
A-:B-:D+:E-	0.0	0
A-:B-:D+:E+	0.0	0
A-:B+:D-:E-	0.0	0
A-:B+:D-:E+	0.0	0
A-:B+:D+:E-	0.0	0
A-:B+:D+:E+	0.0	0
A+:B-:D-:E-	0.0	0
A+:B-:D-:E+	0.0	0
A+:B-:D+:E-	0.0	0
A+:B-:D+:E+	0.0	0
A+:B+:D-:E-	0.0	0
A+:B+:D-:E+	0.0	0
A+:B+:D+:E-	0.0	0
A+:B+:D+:E+	0.0	0
C-:D-:E-	-4.8	0
C-:D-:E+	0.0	0
C-:D+:E-	0.0	0
C-:D+:E+	0.0	0
C+:D-:E-	0.0	0
C+:D-:E+	0.0	0
C+:D+:E-	0.0	0
C+:D+:E+	0.0	0
A-:C-:D-:E-	-0.1	0
A-:C-:D-:E+	0.0	0
A-:C-:D+:E-	0.0	0
A-:C-:D+:E+	0.0	0
A-:C+:D-:E-	0.0	0
A-:C+:D-:E+	0.0	0
A-:C+:D+:E-	0.0	0
A-:C+:D+:E+	0.0	0
A+:C-:D-:E-	0.0	0
A+:C-:D-:E+	0.0	0
A+:C-:D+:E-	0.0	0
A+:C-:D+:E+	0.0	0
A+:C+:D-:E-	0.0	0
A+:C+:D-:E+	0.0	0
A+:C+:D+:E-	0.0	0
A+:C+:D+:E+	0.0	0
B-:C-:D-:E-	9.1	0
B-:C-:D-:E+	0.0	0
B-:C-:D+:E-	0.0	0
B-:C-:D+:E+	0.0	0
B-:C+:D-:E-	0.0	0
B-:C+:D-:E+	0.0	0

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

```
GLM(pl ~ Subject + Period + Treat, antifungal) # OK
```

\$ANOVA

Response : pl

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	18	118.558	6.5866	1.4435	0.2388
RESIDUALS	15	68.444	4.5630		
CORRECTED TOTAL	33	187.002			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	16	114.642	7.1651	1.5703	0.1942
Period	1	0.922	0.9224	0.2021	0.6594
Treat	1	2.993	2.9932	0.6560	0.4306


```
$`Type II`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	16	114.642	7.1651	1.5703	0.1942
Period	1	0.734	0.7344	0.1609	0.6939
Treat	1	2.993	2.9932	0.6560	0.4306

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	16	114.642	7.1651	1.5703	0.1942
Period	1	0.734	0.7344	0.1609	0.6939
Treat	1	2.993	2.9932	0.6560	0.4306

```
$Parameter
```

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	11.9000	1.60208	15	7.4278	2.121e-06 ***
Subject1	-0.4500	2.13611	15	-0.2107	0.83598
Subject2	-1.5500	2.13611	15	-0.7256	0.47924
Subject3	2.7500	2.13611	15	1.2874	0.21747
Subject4	0.4500	2.13611	15	0.2107	0.83598
Subject5	2.8000	2.13611	15	1.3108	0.20964
Subject6	5.2500	2.13611	15	2.4577	0.02663 *
Subject7	1.4500	2.13611	15	0.6788	0.50760
Subject8	0.8500	2.13611	15	0.3979	0.69630
Subject9	2.3500	2.13611	15	1.1001	0.28862
Subject10	3.2000	2.13611	15	1.4981	0.15487
Subject11	1.1500	2.13611	15	0.5384	0.59823
Subject12	0.5000	2.13611	15	0.2341	0.81810
Subject13	-2.9500	2.13611	15	-1.3810	0.18750
Subject14	1.2500	2.13611	15	0.5852	0.56713
Subject15	1.3500	2.13611	15	0.6320	0.53691
Subject16	0.4500	2.13611	15	0.2107	0.83598
Subject17	0.0000	0.00000	15		
Period1	-0.2944	0.73395	15	-0.4012	0.69395
Period2	0.0000	0.00000	15		
TreatA	0.5944	0.73395	15	0.8099	0.43065
TreatB	0.0000	0.00000	15		

```
---
```

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

10.7.2 p355

(178) MODEL

```
GLM(y ~ Group + Subject:Group + Period + Treat + Carry, bioequiv) # OK
```

```
$ANOVA
```

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	39	417852	10714.1	20.367	< 2.2e-16 ***
RESIDUALS	68	35772	526.1		
CORRECTED TOTAL	107	453624			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group	1	43335	43335	82.3763	2.46e-13 ***
Group:Subject	34	370970	10911	20.7406	< 2.2e-16 ***
Period	2	287	143	0.2723	0.7624
Treat	1	2209	2209	4.1993	0.0443 *
Carry	1	1051	1051	1.9970	0.1622

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group	1	32616	32616	61.9998	3.712e-11 ***
Group:Subject	34	370970	10911	20.7406	< 2.2e-16 ***
Period	1	38	38	0.0724	0.7888
Treat	1	2209	2209	4.1993	0.0443 *
Carry	1	1051	1051	1.9970	0.1622

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

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group	1	32616	32616	61.9998	3.712e-11 ***
Group:Subject	34	370970	10911	20.7406	< 2.2e-16 ***
Period	1	38	38	0.0724	0.7888
Treat	1	2209	2209	4.1993	0.0443 *
Carry	1	1051	1051	1.9970	0.1622

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	60.210	14.2178	68	4.2349	7.030e-05 ***
Group1	275.892	18.7922	68	14.6812	< 2.2e-16 ***
Group2	0.000	0.0000	68		
Group1:Subject1					
Group1:Subject2	-227.030	18.7273	68	-12.1230	< 2.2e-16 ***
Group1:Subject3	-177.713	18.7273	68	-9.4896	4.441e-14 ***
Group1:Subject4					

Group1:Subject5						
Group1:Subject6	-40.340	18.7273	68	-2.1541	0.0347809	*
Group1:Subject7						
Group1:Subject8	-295.857	18.7273	68	-15.7982	< 2.2e-16	***
Group1:Subject9						
Group1:Subject10	-274.273	18.7273	68	-14.6457	< 2.2e-16	***
Group1:Subject11						
Group1:Subject12	-289.343	18.7273	68	-15.4504	< 2.2e-16	***
Group1:Subject13	-244.527	18.7273	68	-13.0573	< 2.2e-16	***
Group1:Subject14	-214.220	18.7273	68	-11.4389	< 2.2e-16	***
Group1:Subject15						
Group1:Subject16						
Group1:Subject17						
Group1:Subject18	-256.807	18.7273	68	-13.7130	< 2.2e-16	***
Group1:Subject19	-167.663	18.7273	68	-8.9529	4.106e-13	***
Group1:Subject21	-196.253	18.7273	68	-10.4796	8.882e-16	***
Group1:Subject23	-282.743	18.7273	68	-15.0980	< 2.2e-16	***
Group1:Subject24						
Group1:Subject25						
Group1:Subject26	-175.620	18.7273	68	-9.3778	7.061e-14	***
Group1:Subject27						
Group1:Subject28	-224.523	18.7273	68	-11.9891	< 2.2e-16	***
Group1:Subject30						
Group1:Subject31	-231.780	18.7273	68	-12.3766	< 2.2e-16	***
Group1:Subject32						
Group1:Subject33						
Group1:Subject34	-208.733	18.7273	68	-11.1460	< 2.2e-16	***
Group1:Subject35						
Group1:Subject36	-236.827	18.7273	68	-12.6461	< 2.2e-16	***
Group1:Subject120						
Group1:Subject122						
Group1:Subject129	0.000	0.0000	68			
Group2:Subject1	-12.267	18.7273	68	-0.6550	0.5146667	
Group2:Subject2						
Group2:Subject3						
Group2:Subject4	97.027	18.7273	68	5.1810	2.142e-06	***
Group2:Subject5	67.423	18.7273	68	3.6003	0.0005992	***
Group2:Subject6						
Group2:Subject7	20.703	18.7273	68	1.1055	0.2728310	
Group2:Subject8						
Group2:Subject9	13.143	18.7273	68	0.7018	0.4851810	
Group2:Subject10						
Group2:Subject11	102.857	18.7273	68	5.4924	6.396e-07	***
Group2:Subject12						
Group2:Subject13						
Group2:Subject14						
Group2:Subject15	-1.000	18.7273	68	-0.0534	0.9575713	
Group2:Subject16	47.123	18.7273	68	2.5163	0.0142246	*

Group2:Subject17	4.540	18.7273	68	0.2424	0.8091787
Group2:Subject18					
Group2:Subject19					
Group2:Subject21					
Group2:Subject23					
Group2:Subject24	25.713	18.7273	68	1.3730	0.1742498
Group2:Subject25	37.693	18.7273	68	2.0128	0.0481026 *
Group2:Subject26					
Group2:Subject27	29.563	18.7273	68	1.5786	0.1190628
Group2:Subject28					
Group2:Subject30	2.340	18.7273	68	0.1250	0.9009306
Group2:Subject31					
Group2:Subject32	58.270	18.7273	68	3.1115	0.0027208 **
Group2:Subject33	39.150	18.7273	68	2.0905	0.0403104 *
Group2:Subject34					
Group2:Subject35	14.293	18.7273	68	0.7632	0.4479620
Group2:Subject36					
Group2:Subject120	11.667	18.7273	68	0.6230	0.5353829
Group2:Subject122	0.000	0.0000	68		
Group2:Subject129					
Period1	-1.329	6.0442	68	-0.2199	0.8265839
Period2	-1.454	5.4061	68	-0.2690	0.7887545
Period3	0.000	0.0000	68		
TreatA	-9.594	4.6818	68	-2.0492	0.0443021 *
TreatB	0.000	0.0000	68		
CarryA	-7.640	5.4061	68	-1.4132	0.1621674
CarryB	0.000	0.0000	68		
Carrynone	0.000	0.0000	68		

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

(179) MODEL

```
GLM(y ~ Subject + Period + Treat + Carry, bioequiv) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	39	417852	10714.1	20.367	< 2.2e-16 ***
RESIDUALS	68	35772	526.1		
CORRECTED TOTAL	107	453624			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	35	414306	11837.3	22.5016	<2e-16 ***

Period	2	287	143.3	0.2723	0.7624
Treat	1	2209	2209.1	4.1993	0.0443 *
Carry	1	1051	1050.6	1.9970	0.1622

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	35	403586	11531.0	21.9194	<2e-16 ***
Period	1	38	38.1	0.0724	0.7888
Treat	1	2209	2209.1	4.1993	0.0443 *
Carry	1	1051	1050.6	1.9970	0.1622

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

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	35	403586	11531.0	21.9194	<2e-16 ***
Period	1	38	38.1	0.0724	0.7888
Treat	1	2209	2209.1	4.1993	0.0443 *
Carry	1	1051	1050.6	1.9970	0.1622

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	336.10	13.9585	68	24.0787	< 2.2e-16 ***
Subject1	-288.16	18.7922	68	-15.3340	< 2.2e-16 ***
Subject2	-227.03	18.7273	68	-12.1230	< 2.2e-16 ***
Subject3	-177.71	18.7273	68	-9.4896	4.441e-14 ***
Subject4	-178.87	18.7922	68	-9.5181	3.952e-14 ***
Subject5	-208.47	18.7922	68	-11.0934	< 2.2e-16 ***
Subject6	-40.34	18.7273	68	-2.1541	0.03478 *
Subject7	-255.19	18.7922	68	-13.5795	< 2.2e-16 ***
Subject8	-295.86	18.7273	68	-15.7982	< 2.2e-16 ***
Subject9	-262.75	18.7922	68	-13.9818	< 2.2e-16 ***
Subject10	-274.27	18.7273	68	-14.6457	< 2.2e-16 ***
Subject11	-173.04	18.7922	68	-9.2078	1.426e-13 ***
Subject12	-289.34	18.7273	68	-15.4504	< 2.2e-16 ***
Subject13	-244.53	18.7273	68	-13.0573	< 2.2e-16 ***
Subject14	-214.22	18.7273	68	-11.4389	< 2.2e-16 ***
Subject15	-276.89	18.7922	68	-14.7344	< 2.2e-16 ***
Subject16	-228.77	18.7922	68	-12.1736	< 2.2e-16 ***
Subject17	-271.35	18.7922	68	-14.4396	< 2.2e-16 ***
Subject18	-256.81	18.7273	68	-13.7130	< 2.2e-16 ***
Subject19	-167.66	18.7273	68	-8.9529	4.106e-13 ***
Subject21	-196.25	18.7273	68	-10.4796	8.882e-16 ***

Subject23	-282.74	18.7273	68	-15.0980	< 2.2e-16	***
Subject24	-250.18	18.7922	68	-13.3129	< 2.2e-16	***
Subject25	-238.20	18.7922	68	-12.6754	< 2.2e-16	***
Subject26	-175.62	18.7273	68	-9.3778	7.061e-14	***
Subject27	-246.33	18.7922	68	-13.1080	< 2.2e-16	***
Subject28	-224.52	18.7273	68	-11.9891	< 2.2e-16	***
Subject30	-273.55	18.7922	68	-14.5567	< 2.2e-16	***
Subject31	-231.78	18.7273	68	-12.3766	< 2.2e-16	***
Subject32	-217.62	18.7922	68	-11.5805	< 2.2e-16	***
Subject33	-236.74	18.7922	68	-12.5979	< 2.2e-16	***
Subject34	-208.73	18.7273	68	-11.1460	< 2.2e-16	***
Subject35	-261.60	18.7922	68	-13.9206	< 2.2e-16	***
Subject36	-236.83	18.7273	68	-12.6461	< 2.2e-16	***
Subject120	-264.23	18.7922	68	-14.0604	< 2.2e-16	***
Subject122	-275.89	18.7922	68	-14.6812	< 2.2e-16	***
Subject129	0.00	0.0000	68			
Period1	-1.33	6.0442	68	-0.2199	0.82658	
Period2	-1.45	5.4061	68	-0.2690	0.78875	
Period3	0.00	0.0000	68			
TreatA	-9.59	4.6818	68	-2.0492	0.04430	*
TreatB	0.00	0.0000	68			
CarryA	-7.64	5.4061	68	-1.4132	0.16217	
CarryB	0.00	0.0000	68			
Carrynone	0.00	0.0000	68			

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

10.7.3 p361

(180) MODEL

```
GLM(Time ~ Subject + Period + Treat + Carry, chipman) # OK
```

\$ANOVA

Response : Time

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	17	28.0757	1.65151	64.421	1.139e-12 ***
RESIDUALS	18	0.4615	0.02564		
CORRECTED TOTAL	35	28.5372			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	11	24.2084	2.20076	85.8462	3.157e-13 ***
Period	2	3.2065	1.60325	62.5388	7.894e-09 ***

Treat	2	0.4276	0.21382	8.3406	0.002733	**
Carry	2	0.2332	0.11660	4.5484	0.025188	*

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	11	24.2547	2.20497	86.0105	3.104e-13 ***
Period	1	0.0018	0.00184	0.0717	0.7919554
Treat	2	0.6392	0.31958	12.4661	0.0004003 ***
Carry	2	0.2332	0.11660	4.5484	0.0251881 *

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

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	11	24.2547	2.20497	86.0105	3.104e-13 ***
Period	1	0.0018	0.00184	0.0717	0.7919554
Treat	2	0.6392	0.31958	12.4661	0.0004003 ***
Carry	2	0.2332	0.11660	4.5484	0.0251881 *

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	7.2383	0.142461	18	50.8091	< 2.2e-16 ***
Subject1	-1.9179	0.134755	18	-14.2326	3.093e-11 ***
Subject2	-1.4912	0.134755	18	-11.0664	1.838e-09 ***
Subject3	0.4200	0.130732	18	3.2127	0.0048259 **
Subject4	-1.1700	0.130732	18	-8.9496	4.788e-08 ***
Subject5	0.3621	0.134755	18	2.6870	0.0150624 *
Subject6	-0.3046	0.134755	18	-2.2603	0.0364348 *
Subject7	-1.6946	0.134755	18	-12.5753	2.366e-10 ***
Subject8	-1.3746	0.134755	18	-10.2006	6.573e-09 ***
Subject9	-1.5446	0.134755	18	-11.4622	1.052e-09 ***
Subject10	0.1288	0.134755	18	0.9554	0.3520132
Subject11	-1.2033	0.130732	18	-9.2046	3.148e-08 ***
Subject12	0.0000	0.000000	18		
Period1	0.4550	0.086471	18	5.2619	5.286e-05 ***
Period2	-0.0175	0.065366	18	-0.2677	0.7919554
Period3	0.0000	0.000000	18		
Treat1	-0.2654	0.073081	18	-3.6318	0.0019073 **
Treat2	-0.3496	0.073081	18	-4.7835	0.0001487 ***
Treat3	0.0000	0.000000	18		
Carry0	0.0000	0.000000	18		
Carry1	-0.2337	0.098049	18	-2.3840	0.0283404 *
Carry2	-0.2737	0.098049	18	-2.7920	0.0120418 *

```
Carry3          0.0000    0.000000 18
```

```
---
```

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

10.7.4 p372

(181) MODEL

```
residue$lc1 = log(residue$X1)
residue$lc2 = log(residue$X2)
residue$lc3 = log(residue$X3)
residue$lc4 = log(residue$X4)
residue$lc5 = log(residue$X5)
residue$sp = 7*residue$lc2+ 14*residue$lc3 + 30*residue$lc4 + 60*residue$lc5
residue$sm = residue$lc1 + residue$lc2+ residue$lc3 + residue$lc4 + residue$lc5
residue$num = 5*residue$sp - 111*residue$sm
residue$den = 5*4745 - 111^2
residue$k = residue$num/residue$den
residue$HL = -log(2)/residue$k
residue$logHL = log(residue$HL)
GLM(logHL ~ temp*moisture*soil, residue) # OK
```

\$ANOVA

Response : logHL

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	7	7.5133	1.07332	13.543	0.0007329 ***
RESIDUALS	8	0.6340	0.07925		
CORRECTED TOTAL	15	8.1473			

```
---
```

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
temp	1	6.0503	6.0503	76.3427	2.303e-05 ***
moisture	1	0.9521	0.9521	12.0134	0.008492 **
temp:moisture	1	0.0013	0.0013	0.0162	0.901779
soil	1	0.4098	0.4098	5.1712	0.052559 .
temp:soil	1	0.0086	0.0086	0.1081	0.750753
moisture:soil	1	0.0860	0.0860	1.0855	0.327921
temp:moisture:soil	1	0.0051	0.0051	0.0648	0.805427

```
---
```

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
temp	1	6.0503	6.0503	76.3427	2.303e-05 ***

moisture	1	0.9521	0.9521	12.0134	0.008492	**
temp:moisture	1	0.0013	0.0013	0.0162	0.901779	
soil	1	0.4098	0.4098	5.1712	0.052559	.
temp:soil	1	0.0086	0.0086	0.1081	0.750753	
moisture:soil	1	0.0860	0.0860	1.0855	0.327921	
temp:moisture:soil	1	0.0051	0.0051	0.0648	0.805427	

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
temp	1	6.0503	6.0503	76.3427	2.303e-05	***
moisture	1	0.9521	0.9521	12.0134	0.008492	**
temp:moisture	1	0.0013	0.0013	0.0162	0.901779	
soil	1	0.4098	0.4098	5.1712	0.052559	.
temp:soil	1	0.0086	0.0086	0.1081	0.750753	
moisture:soil	1	0.0860	0.0860	1.0855	0.327921	
temp:moisture:soil	1	0.0051	0.0051	0.0648	0.805427	

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)	
(Intercept)	4.2566	0.19906	8	21.3832	2.407e-08	***
temp10	1.2582	0.28152	8	4.4695	0.002085	**
temp30	0.0000	0.00000	8			
moistureH	-0.3591	0.28152	8	-1.2757	0.237854	
moistureL	0.0000	0.00000	8			
temp10:moistureH	0.0358	0.39813	8	0.0900	0.930514	
temp10:moistureL	0.0000	0.00000	8			
temp30:moistureH	0.0000	0.00000	8			
temp30:moistureL	0.0000	0.00000	8			
soilC	0.4772	0.28152	8	1.6950	0.128514	
soilP	0.0000	0.00000	8			
temp10:soilC	-0.0209	0.39813	8	-0.0524	0.959466	
temp10:soilP	0.0000	0.00000	8			
temp30:soilC	0.0000	0.00000	8			
temp30:soilP	0.0000	0.00000	8			
moistureH:soilC	-0.2216	0.39813	8	-0.5567	0.592977	
moistureH:soilP	0.0000	0.00000	8			
moistureL:soilC	0.0000	0.00000	8			
moistureL:soilP	0.0000	0.00000	8			
temp10:moistureH:soilC	-0.1434	0.56303	8	-0.2546	0.805427	
temp10:moistureH:soilP	0.0000	0.00000	8			
temp10:moistureL:soilC	0.0000	0.00000	8			
temp10:moistureL:soilP	0.0000	0.00000	8			
temp30:moistureH:soilC	0.0000	0.00000	8			
temp30:moistureH:soilP	0.0000	0.00000	8			

```
temp30:moistureL:soilC    0.0000    0.00000 8
temp30:moistureL:soilP    0.0000    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

```
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

```
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

```

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

```
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

```
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

```
prod2 = af(prodstd, 1:7)
GLM(Pof ~ A + B + C + D + E + F + G + A:G + A:E:F + B:E:G + C:E:G + C:E:G:F +
      D:E + D:F, prod2) # OK
```

\$ANOVA

Response : Pof

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	47	769.49	16.3721	5.1667	2.737e-05 ***
RESIDUALS	24	76.05	3.1688		
CORRECTED TOTAL	71	845.54			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
A	2	50.577	25.288	7.9806	0.0022023	**
B	2	13.384	6.692	2.1118	0.1429491	
C	2	68.594	34.297	10.8234	0.0004463	***
D	2	23.674	11.837	3.7355	0.0386914	*
E	1	275.733	275.733	87.0165	1.878e-09	***
F	1	161.700	161.700	51.0296	2.204e-07	***
G	1	1.051	1.051	0.3318	0.5699896	
A:G	2	26.567	13.284	4.1921	0.0274494	*
A:E:F	7	28.404	4.058	1.2806	0.3013844	
B:E:G	7	22.453	3.208	1.0123	0.4475160	
C:E:G	6	35.546	5.924	1.8696	0.1277692	
C:E:F:G	10	24.607	2.461	0.7766	0.6500534	
D:E	2	21.745	10.873	3.4312	0.0489076	*
D:F	2	15.450	7.725	2.4379	0.1086730	

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
A	2	50.577	25.288	7.9806	0.0022023	**
B	2	13.384	6.692	2.1118	0.1429491	
C	2	68.594	34.297	10.8234	0.0004463	***
D	2	23.674	11.837	3.7355	0.0386914	*
E	1	275.733	275.733	87.0165	1.878e-09	***
F	1	161.700	161.700	51.0296	2.204e-07	***
G	1	1.051	1.051	0.3318	0.5699896	
A:G	2	26.567	13.284	4.1921	0.0274494	*
A:E:F	6	24.623	4.104	1.2951	0.2970196	
B:E:G	6	19.770	3.295	1.0398	0.4246194	
C:E:G	6	35.546	5.924	1.8696	0.1277692	
C:E:F:G	10	24.607	2.461	0.7766	0.6500534	
D:E	2	21.745	10.873	3.4312	0.0489076	*
D:F	2	15.450	7.725	2.4379	0.1086730	

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

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
A	2	50.577	25.288	7.9806	0.0022023	**
B	2	13.384	6.692	2.1118	0.1429491	
C	2	68.594	34.297	10.8234	0.0004463	***
D	2	23.674	11.837	3.7355	0.0386914	*

E	1	275.733	275.733	87.0165	1.878e-09	***
F	1	161.700	161.700	51.0296	2.204e-07	***
G	1	1.051	1.051	0.3318	0.5699896	
A:G	2	26.567	13.284	4.1921	0.0274494	*
A:E:F	6	24.623	4.104	1.2951	0.2970196	
B:E:G	6	19.770	3.295	1.0398	0.4246194	
C:E:G	6	35.546	5.924	1.8696	0.1277692	
C:E:F:G	10	24.607	2.461	0.7766	0.6500534	
D:E	2	21.745	10.873	3.4312	0.0489076	*
D:F	2	15.450	7.725	2.4379	0.1086730	

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)	
(Intercept)	23.9833	1.45344	24	16.5010	1.332e-14	***
A1	-4.1208	1.14905	24	-3.5863	0.001487	**
A2	-0.1792	1.14905	24	-0.1559	0.877395	
A3	0.0000	0.00000	24			
B1	-1.9500	1.02774	24	-1.8974	0.069875	.
B2	-0.3000	1.02774	24	-0.2919	0.772869	
B3	0.0000	0.00000	24			
C1	0.3000	1.45344	24	0.2064	0.838215	
C2	2.6333	1.45344	24	1.8118	0.082552	.
C3	0.0000	0.00000	24			
D1	1.6042	0.89005	24	1.8023	0.084067	.
D2	0.2958	0.89005	24	0.3324	0.742489	
D3	0.0000	0.00000	24			
E1	-4.2111	1.96797	24	-2.1398	0.042742	*
E2	0.0000	0.00000	24			
F1	-3.1556	1.78010	24	-1.7727	0.088975	.
F2	0.0000	0.00000	24			
G1	0.0889	1.78010	24	0.0499	0.960588	
G2	0.0000	0.00000	24			
A1:G1	2.9750	1.02774	24	2.8947	0.007959	**
A1:G2	0.0000	0.00000	24			
A2:G1	1.4250	1.02774	24	1.3865	0.178329	
A2:G2	0.0000	0.00000	24			
A3:G1	0.0000	0.00000	24			
A3:G2	0.0000	0.00000	24			
A1:E1:F1	2.2667	2.78313	24	0.8144	0.423407	
A1:E1:F2	2.6333	1.45344	24	1.8118	0.082552	.
A1:E2:F1	2.7833	1.45344	24	1.9150	0.067486	.
A1:E2:F2	0.0000	0.00000	24			
A2:E1:F1	1.9667	2.78313	24	0.7066	0.486596	
A2:E1:F2	1.3500	1.45344	24	0.9288	0.362226	
A2:E2:F1	-0.1000	1.45344	24	-0.0688	0.945717	
A2:E2:F2	0.0000	0.00000	24			

A3:E1:F1	1.6333	2.37346	24	0.6882	0.497948
A3:E1:F2	0.0000	0.00000	24		
A3:E2:F1	0.0000	0.00000	24		
A3:E2:F2	0.0000	0.00000	24		
B1:E1:G1	-1.6278	2.78313	24	-0.5849	0.564092
B1:E1:G2	2.3667	1.45344	24	1.6283	0.116516
B1:E2:G1	1.3000	1.45344	24	0.8944	0.379976
B1:E2:G2	0.0000	0.00000	24		
B2:E1:G1	-3.5611	2.78313	24	-1.2795	0.212941
B2:E1:G2	1.3500	1.45344	24	0.9288	0.362226
B2:E2:G1	1.8333	1.45344	24	1.2614	0.219298
B2:E2:G2	0.0000	0.00000	24		
B3:E1:G1	-3.1611	2.37346	24	-1.3319	0.195419
B3:E1:G2	0.0000	0.00000	24		
B3:E2:G1	0.0000	0.00000	24		
B3:E2:G2	0.0000	0.00000	24		
C1:E1:G1	-1.9333	2.05548	24	-0.9406	0.356294
C1:E1:G2	-2.9000	2.05548	24	-1.4109	0.171117
C1:E2:G1	-3.4333	2.05548	24	-1.6703	0.107846
C1:E2:G2	0.0000	0.00000	24		
C2:E1:G1	-2.4000	2.05548	24	-1.1676	0.254434
C2:E1:G2	-5.5667	2.05548	24	-2.7082	0.012273 *
C2:E2:G1	-4.3333	2.05548	24	-2.1082	0.045643 *
C2:E2:G2	0.0000	0.00000	24		
C3:E1:G1	0.0000	0.00000	24		
C3:E1:G2	0.0000	0.00000	24		
C3:E2:G1	0.0000	0.00000	24		
C3:E2:G2	0.0000	0.00000	24		
C1:E1:F1:G1	1.3000	2.05548	24	0.6325	0.533069
C1:E1:F1:G2	-1.7333	2.05548	24	-0.8433	0.407402
C1:E1:F2:G1	0.0000	0.00000	24		
C1:E1:F2:G2	0.0000	0.00000	24		
C1:E2:F1:G1	-1.5000	2.05548	24	-0.7298	0.472602
C1:E2:F1:G2	-0.1000	2.05548	24	-0.0487	0.961600
C1:E2:F2:G1	0.0000	0.00000	24		
C1:E2:F2:G2	0.0000	0.00000	24		
C2:E1:F1:G1	0.5667	2.05548	24	0.2757	0.785149
C2:E1:F1:G2	2.6333	2.05548	24	1.2811	0.212390
C2:E1:F2:G1	0.0000	0.00000	24		
C2:E1:F2:G2	0.0000	0.00000	24		
C2:E2:F1:G1	0.9667	2.05548	24	0.4703	0.642395
C2:E2:F1:G2	-1.5667	2.05548	24	-0.7622	0.453373
C2:E2:F2:G1	0.0000	0.00000	24		
C2:E2:F2:G2	0.0000	0.00000	24		
C3:E1:F1:G1	1.8000	2.05548	24	0.8757	0.389869
C3:E1:F1:G2	0.0000	0.00000	24		
C3:E1:F2:G1	0.0000	0.00000	24		
C3:E1:F2:G2	0.0000	0.00000	24		

```

C3:E2:F1:G1  -0.3333      2.05548 24 -0.1622  0.872531
C3:E2:F1:G2   0.0000      0.00000 24
C3:E2:F2:G1   0.0000      0.00000 24
C3:E2:F2:G2   0.0000      0.00000 24
D1:E1         -0.2583      1.02774 24 -0.2514  0.803675
D1:E2          0.0000      0.00000 24
D2:E1          2.1917      1.02774 24  2.1325  0.043397 *
D2:E2          0.0000      0.00000 24
D3:E1          0.0000      0.00000 24
D3:E2          0.0000      0.00000 24
D1:F1         -0.2417      1.02774 24 -0.2351  0.816092
D1:F2          0.0000      0.00000 24
D2:F1         -2.0750      1.02774 24 -2.0190  0.054793 .
D2:F2          0.0000      0.00000 24
D3:F1          0.0000      0.00000 24
D3:F2          0.0000      0.00000 24

```

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

10.9.4 p532

(189) MODEL

```
GLM(torque ~ A + B + C + D + E + A:B + A:C + A:D + A:E, Smotor) # OK
```

\$ANOVA

Response : torque

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	15	0.0112217	0.00074811	102.2	0.009731 **
RESIDUALS	2	0.0000146	0.00000732		
CORRECTED TOTAL	17	0.0112363			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	0.0039545	0.0039545	540.2187	0.001846 **
B	2	0.0003817	0.0001909	26.0732	0.036937 *
C	2	0.0057241	0.0028620	390.9837	0.002551 **
D	2	0.0000265	0.0000133	1.8104	0.355820
E	1	0.0000984	0.0000984	13.4406	0.067009 .
A:B	2	0.0010068	0.0005034	68.7668	0.014333 *
A:C	2	0.0000031	0.0000016	0.2134	0.824110
A:D	2	0.0000009	0.0000004	0.0599	0.943521
A:E	1	0.0000258	0.0000258	3.5198	0.201458

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	0.0039545	0.0039545	540.2187	0.001846 **
B	2	0.0003817	0.0001909	26.0732	0.036937 *
C	2	0.0032014	0.0016007	218.6753	0.004552 **
D	2	0.0000268	0.0000134	1.8319	0.353123
E	1	0.0000423	0.0000423	5.7744	0.138172
A:B	2	0.0010068	0.0005034	68.7668	0.014333 *
A:C	2	0.0000031	0.0000016	0.2134	0.824110
A:D	2	0.0000052	0.0000026	0.3536	0.738760
A:E	1	0.0000258	0.0000258	3.5198	0.201458

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	0.0034241	0.0034241	467.7636	0.002131 **
B	2	0.0003817	0.0001909	26.0732	0.036937 *
C	2	0.0032014	0.0016007	218.6753	0.004552 **
D	2	0.0000268	0.0000134	1.8319	0.353123
E	1	0.0000423	0.0000423	5.7744	0.138172
A:B	2	0.0010068	0.0005034	68.7668	0.014333 *
A:C	2	0.0000031	0.0000016	0.2134	0.824110
A:D	2	0.0000052	0.0000026	0.3536	0.738760
A:E	1	0.0000258	0.0000258	3.5198	0.201458

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

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	0.289577	0.0034044	2	85.0589	0.0001382 ***
A1	-0.032740	0.0042779	2	-7.6533	0.0166477 *
A2	0.000000	0.0000000	2		
B1	-0.009206	0.0022091	2	-4.1673	0.0530418 .
B2	0.013405	0.0022091	2	6.0681	0.0260991 *
B3	0.000000	0.0000000	2		
C1	-0.040333	0.0030249	2	-13.3336	0.0055778 **
C2	-0.023615	0.0030249	2	-7.8068	0.0160147 *
C3	0.000000	0.0000000	2		
D1	0.004119	0.0030249	2	1.3617	0.3063965
D2	0.004196	0.0027056	2	1.5509	0.2610866
D3	0.000000	0.0000000	2		
E1	-0.001008	0.0027056	2	-0.3726	0.7452485
E2	0.000000	0.0000000	2		
A1:B1	0.029389	0.0031241	2	9.4070	0.0111124 *
A1:B2	-0.004253	0.0031241	2	-1.3612	0.3065165

A1:B3	0.000000	0.0000000	2		
A2:B1	0.000000	0.0000000	2		
A2:B2	0.000000	0.0000000	2		
A2:B3	0.000000	0.0000000	2		
A1:C1	-0.002699	0.0042779	2	-0.6310	0.5925465
A1:C2	-0.001250	0.0042779	2	-0.2923	0.7976178
A1:C3	0.000000	0.0000000	2		
A2:C1	0.000000	0.0000000	2		
A2:C2	0.000000	0.0000000	2		
A2:C3	0.000000	0.0000000	2		
A1:D1	-0.003579	0.0042779	2	-0.8367	0.4908121
A1:D2	-0.001141	0.0038262	2	-0.2983	0.7935889
A1:D3	0.000000	0.0000000	2		
A2:D1	0.000000	0.0000000	2		
A2:D2	0.000000	0.0000000	2		
A2:D3	0.000000	0.0000000	2		
A1:E1	-0.007178	0.0038262	2	-1.8761	0.2014578
A1:E2	0.000000	0.0000000	2		
A2:E1	0.000000	0.0000000	2		
A2:E2	0.000000	0.0000000	2		

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

10.9.5 p535

(190) MODEL

```
GLM(shrinkage ~ A + B + C + D + E + F + G + A:B + A:C + A:D + A:E + A:F + A:G +
      B:D, inject) # OK
```

\$ANOVA

Response : shrinkage

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	14	6659.4	475.67	129.08	1.97e-05 ***
RESIDUALS	5	18.4	3.68		
CORRECTED TOTAL	19	6677.8			

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	770.1	770.1	208.9722	2.858e-05 ***
B	1	5076.6	5076.6	1377.6289	2.674e-07 ***
C	1	3.1	3.1	0.8311	0.403773
D	1	7.6	7.6	2.0522	0.211416
E	1	0.6	0.6	0.1526	0.712112

F	1	0.6	0.6	0.1526	0.712112
G	1	95.1	95.1	25.7972	0.003837 **
A:B	1	564.1	564.1	153.0699	6.112e-05 ***
A:C	1	10.6	10.6	2.8664	0.151230
A:D	1	115.6	115.6	31.3602	0.002508 **
A:E	1	14.1	14.1	3.8161	0.108185
A:F	1	1.6	1.6	0.4240	0.543677
A:G	1	0.1	0.1	0.0170	0.901459
B:D	1	0.1	0.1	0.0170	0.901459

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
A	1	770.1	770.1	208.9722	2.858e-05	***
B	1	5076.6	5076.6	1377.6289	2.674e-07	***
C	1	3.1	3.1	0.8311	0.403773	
D	1	7.6	7.6	2.0522	0.211416	
E	1	0.6	0.6	0.1526	0.712112	
F	1	0.6	0.6	0.1526	0.712112	
G	1	95.1	95.1	25.7972	0.003837	**
A:B	1	564.1	564.1	153.0699	6.112e-05	***
A:C	1	10.6	10.6	2.8664	0.151230	
A:D	1	115.6	115.6	31.3602	0.002508	**
A:E	1	14.1	14.1	3.8161	0.108185	
A:F	1	1.6	1.6	0.4240	0.543677	
A:G	1	0.1	0.1	0.0170	0.901459	
B:D	1	0.1	0.1	0.0170	0.901459	

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
A	1	770.1	770.1	208.9722	2.858e-05	***
B	1	5076.6	5076.6	1377.6289	2.674e-07	***
C	1	3.1	3.1	0.8311	0.403773	
D	1	7.6	7.6	2.0522	0.211416	
E	1	0.6	0.6	0.1526	0.712112	
F	1	0.6	0.6	0.1526	0.712112	
G	1	95.1	95.1	25.7972	0.003837	**
A:B	1	564.1	564.1	153.0699	6.112e-05	***
A:C	1	10.6	10.6	2.8664	0.151230	
A:D	1	115.6	115.6	31.3602	0.002508	**
A:E	1	14.1	14.1	3.8161	0.108185	
A:F	1	1.6	1.6	0.4240	0.543677	
A:G	1	0.1	0.1	0.0170	0.901459	
B:D	1	0.1	0.1	0.0170	0.901459	

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

\$Parameter

	Estimate	Std. Error	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

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

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

```
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

```
percent = c(31,33,44,36,38,26,37,59,42,42,34,42,28,39,36,32,38,42,36,22,42,46,
            26,37,43)
refinery = c(rep("g",9),rep("n",8),rep("s",8))
process = as.factor(c(1,1,1,1,1,1,2,2,2,1,1,1,1,2,2,2,2,1,1,1,2,2,2,2,2))
source0 = c("t","t","t","t","o","m","t","t","o","m","i","i","i","t","o","m","m",
            "t","o","i","o","o","m","i","i")
d2 = data.frame(percent, refinery, process, source=source0)
GLM(percent ~ refinery*source, d2)
```

\$ANOVA

Response : percent

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	10	442.56	44.256	0.6361	0.7616
RESIDUALS	14	974.00	69.571		
CORRECTED TOTAL	24	1416.56			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
refinery	2	20.963	10.481	0.1507	0.8615
source	3	266.124	88.708	1.2751	0.3212
refinery:source	5	155.474	31.095	0.4469	0.8086

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
refinery	2	25.535	12.767	0.1835	0.8343
source	3	266.124	88.708	1.2751	0.3212
refinery:source	5	155.474	31.095	0.4469	0.8086

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
refinery	2	10.766	5.383	0.0774	0.9259
source	3	282.633	94.211	1.3542	0.2972
refinery:source	5	155.474	31.095	0.4469	0.8086

\$Parameter

	Estimate	Std. Error	Df	t value	Pr(> t)
(Intercept)	42.000	8.3409	14	5.0354	0.0001822 ***
refineryg	-2.000	9.0093	14	-0.2220	0.8275243
refineryn	-3.000	11.7959	14	-0.2543	0.8029412
refinerys	0.000	0.0000	14		
sourcei	-8.000	9.6313	14	-0.8306	0.4201255
sourcem	-16.000	11.7959	14	-1.3564	0.1964425
sourceo	-0.667	9.6313	14	-0.0692	0.9457944

```

sourcet          0.000      0.0000 14
refineryg:sourcei
refineryg:sourcem  2.000     14.8428 14  0.1347 0.8947314
refineryg:sourceo  0.667     11.7959 14  0.0565 0.9557287
refineryg:sourcet  0.000      0.0000 14
refineryn:sourcei  3.667     13.6207 14  0.2692 0.7917042
refineryn:sourcem 14.333     15.2284 14  0.9412 0.3625491
refineryn:sourceo -2.333     15.2284 14 -0.1532 0.8804095
refineryn:sourcet  0.000      0.0000 14
refinerys:sourcei  0.000      0.0000 14
refinerys:sourcem  0.000      0.0000 14
refinerys:sourceo  0.000      0.0000 14
refinerys:sourcet  0.000      0.0000 14
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

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	0.5.1	193	193 (100%)	0 (0%)
car	3.0.10	193	< 174 (90%)	>= 20 (10%)

All of the results in sasLM 0.5.1 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 4.0.4 (2021-02-15)

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_1.2-5 car_3.0-10 carData_3.0-4 sasLM_0.5.1 rmarkdown_2.6

loaded via a namespace (and not attached):

[1] gmp_0.6-2	zip_2.1.1	Rcpp_1.0.6
[4] mathjaxr_1.2-0	compiler_4.0.4	pillar_1.4.7
[7] cellranger_1.1.0	numbers_0.7-5	partitions_1.10-1
[10] forcats_0.5.1	tools_4.0.4	digest_0.6.27
[13] evaluate_0.14	lifecycle_1.0.0	tibble_3.0.6
[16] lattice_0.20-41	pkgconfig_2.0.3	rlang_0.4.10
[19] igraph_1.2.6	openxlsx_4.2.3	curl_4.3
[22] yaml_2.2.1	polynom_1.4-0	haven_2.3.1
[25] xfun_0.21	rio_0.5.16	stringr_1.4.0
[28] knitr_1.31	vctrs_0.3.6	hms_1.0.0
[31] scatterplot3d_0.3-41	combinat_0.0-8	lmtest_0.9-38
[34] vcd_1.4-8	grid_4.0.4	DoE.base_1.1-6
[37] data.table_1.13.6	readxl_1.3.1	conf.design_2.0.0
[40] foreign_0.8-81	FrF2_2.2-2	magrittr_2.0.1
[43] sfsmisc_1.1-8	ellipsis_0.3.1	htmltools_0.5.1.1
[46] MASS_7.3-53.1	abind_1.4-5	colorspace_2.0-0
[49] tinytex_0.29	stringi_1.5.3	crayon_1.4.1
[52] zoo_1.8-8		