

# Validation of 'sasLM' Package

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# 1 Tested Version and Books used for the Validation

## 1.1 Packages Used

- 'sasLM' version: 0.5.0
- 'SAS' version: 9.4 Licensed and University Edition
- 'car' version: 3.0.10
- R version: R version 4.0.3 (2020-10-10)

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	t value	Pr(> t )
(Intercept)	5	0.85635	5.8387	3.261e-05 ***
Ration1	-1	1.35401	-0.7385	0.4716
Ration2	1	1.13284	0.8827	0.3913
Ration3	0	0.00000		

---

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

### 2.2 p42

(2) MODEL

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

\$ANOVA

Response : Y

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

\$`Type I`

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

\$`Type II`

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

\$`Type III`

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

\$Parameter

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

---

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

(3) MODEL

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

\$ANOVA

Response : Y

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

CORRECTED TOTAL 17 77.111

---

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Sire	2	11.1111	5.5556	2.5575	0.118799
Ration	1	9.7079	9.7079	4.4691	0.056129 .
Sire:Ration	2	30.2255	15.1127	6.9573	0.009859 **

---

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Sire	2	15.6829	7.8414	3.6099	0.059238 .
Ration	1	9.7079	9.7079	4.4691	0.056129 .
Sire:Ration	2	30.2255	15.1127	6.9573	0.009859 **

---

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Sire	2	21.0007	10.5004	4.8339	0.028853 *
Ration	1	3.5919	3.5919	1.6535	0.222736
Sire:Ration	2	30.2255	15.1127	6.9573	0.009859 **

---

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

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	5.4000	0.65912	8.1927	2.944e-06 ***
Sire1	-2.9000	1.23311	-2.3518	0.03659 *
Sire2	2.9333	1.07634	2.7253	0.01843 *
Sire3	0.0000	0.00000		
Ration1	-2.4000	1.61452	-1.4865	0.16294
Ration2	0.0000	0.00000		
Sire1:Ration1	5.4000	2.18607	2.4702	0.02948 *
Sire1:Ration2	0.0000	0.00000		
Sire2:Ration1	-1.3333	1.94041	-0.6871	0.50506
Sire2:Ration2	0.0000	0.00000		
Sire3:Ration1	0.0000	0.00000		
Sire3:Ration2	0.0000	0.00000		

---

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

## 2.3 p101

### (4) MODEL

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

\$ANOVA

Response : Gain

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

CAUTION: Singularity Exists !

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



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

```
---
```

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

```
$Parameter
```

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

```
---
```

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

## (5) MODEL

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

```
$ANOVA
```

```
Response : Gain
```

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

```
---
```

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

CAUTION: Singularity Exists !

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

---

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

\$Parameter

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

Dam5:Line1	0.00000	0.00000
Dam5:Line2	0.00000	0.00000
Dam5:Line3	0.00000	0.00000

---

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

### 3 Snee EMS ANOVA 1974

#### Reference

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

#### (6) MODEL

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

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	167	751.27	4.4986		
RESIDUALS	0	0.00			
CORRECTED TOTAL	167	751.27			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Day	41	365.58	8.9166		
Day:Machine	42	196.59	4.6807		
Day:Machine:Analyst	42	118.80	2.8285		
Day:Machine:Analyst:Test	42	70.30	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	t value	Pr(> t )
(Intercept)	6.8			
Day1	2.0			
Day2	1.3			

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

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

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

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



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

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

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

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

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

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

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

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



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

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

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

## 4 Goodnight

### Reference

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

### 4.1 Type I SS

#### 4.1.1 p7

(7) MODEL

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

\$ANOVA

Response : y

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

---

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

## (8) MODEL

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

\$ANOVA

Response : y

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

```

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

```

```

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

```

```

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

```

#### (9) MODEL

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

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```

(10) MODEL

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

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```

(11) MODEL

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

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```

(12) MODEL

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

```

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

```

```

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

```

```

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

```

```

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

```



```

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

```

```

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

```

## 4.2 Type II SS

### 4.2.1 p14

(13) MODEL

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

```

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

```

```

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

```

```

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

```

\$`Type III`

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

\$Parameter

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

---

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

#### 4.2.2 p24

(14) MODEL

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

---

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

## 4.3 Type III SS

### 4.3.1 p27

(15) MODEL

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

\$ANOVA

Response : y

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

---

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

### 4.3.2 p33

(16) MODEL

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

\$ANOVA

Response : y

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

\$`Type I`

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

\$`Type II`

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

\$`Type III`

CAUTION: Singularity Exists !

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

\$Parameter

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

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

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

## 5 SAS for Linear Models 4e

### Reference

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

### 5.1 Chapter 2

#### 5.1.1 p5

(17) MODEL

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

\$ANOVA

Response : COST

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	1	6582.1	6582.1	59.34	6.083e-07 ***
RESIDUALS	17	1885.7	110.9		
CORRECTED TOTAL	18	8467.8			

---

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
CATTLE	1	6582.1	6582.1	59.34	6.083e-07 ***

---

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
CATTLE	1	6582.1	6582.1	59.34	6.083e-07 ***

---

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
CATTLE	1	6582.1	6582.1	59.34	6.083e-07 ***

---

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

\$Parameter

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

---

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

### 5.1.2 p12

(18) MODEL

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

\$ANOVA

Response : COST

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	4	7936.7	1984.18	52.31	2.885e-08 ***
RESIDUALS	14	531.0	37.93		
CORRECTED TOTAL	18	8467.8			

---

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
CATTLE	1	6582.1	6582.1	173.5265	2.801e-09 ***
CALVES	1	186.7	186.7	4.9213	0.0435698 *
HOGS	1	489.9	489.9	12.9145	0.0029351 **
SHEEP	1	678.1	678.1	17.8773	0.0008431 ***

---

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
CATTLE	1	2200.71	2200.71	58.0183	2.413e-06 ***
CALVES	1	136.08	136.08	3.5876	0.0790616 .
HOGS	1	113.66	113.66	2.9964	0.1054198
SHEEP	1	678.11	678.11	17.8773	0.0008431 ***

---

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
CATTLE	1	2200.71	2200.71	58.0183	2.413e-06 ***
CALVES	1	136.08	136.08	3.5876	0.0790616 .
HOGS	1	113.66	113.66	2.9964	0.1054198
SHEEP	1	678.11	678.11	17.8773	0.0008431 ***

---

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



```

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

```

(19) MODEL

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

```

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

```

```

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

```

```

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

```

```

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

```

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

(20) MODEL

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

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

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

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

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

```
$Parameter
```

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	1.0709	3.5272	0.3036	0.7655951
CATTLE	3.3665	0.4397	7.6568	1.471e-06 ***
CALVES	2.1046	0.8547	2.4624	0.0263909 *
SHEEP	0.9267	0.1871	4.9528	0.0001735 ***

---

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

(21) MODEL

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

\$ANOVA

Response : COST

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	3	7936.7	2645.6	74.726	3.011e-09 ***
RESIDUALS	15	531.1	35.4		
CORRECTED TOTAL	18	8467.8			

---

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
CATTLE	1	6582.1	6582.1	185.9151	7.406e-10 ***
CALVES	1	186.7	186.7	5.2726	0.03649 *
I(HOGS + SHEEP)	1	1168.0	1168.0	32.9896	3.883e-05 ***

---

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
CATTLE	1	2215.48	2215.48	62.5775	9.887e-07 ***
CALVES	1	155.03	155.03	4.3788	0.0538 .
I(HOGS + SHEEP)	1	1167.96	1167.96	32.9896	3.883e-05 ***

---

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
CATTLE	1	2215.48	2215.48	62.5775	9.887e-07 ***
CALVES	1	155.03	155.03	4.3788	0.0538 .
I(HOGS + SHEEP)	1	1167.96	1167.96	32.9896	3.883e-05 ***

---

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

\$Parameter

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

```

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

```

(22) MODEL

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

```

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

```

## 5.2 Chapter 3

### 5.2.1 p63

(23) MODEL

```

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

```

\$ANOVA

Response : fruitwt

```

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

```

```

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

```

\$`Type I`

```

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

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

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

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

```

## 5.2.2 p72

(24) MODEL

```

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

```

\$ANOVA

Response : wtloss

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

---

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

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

\$ANOVA

Response : shrink

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

```

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

```

### 5.2.3 p75

(25) MODEL

```

p75w = read.table("C:/G/Rt/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	t value	Pr(> t )
(Intercept)	12.5500	1.8097	6.9348	1.23e-09 ***
methoda	9.7833	2.5593	3.8226	0.0002707 ***
methodb	6.6667	2.5593	2.6049	0.0110772 *
methodc	0.0000	0.0000		
variety1	5.8667	2.5593	2.2923	0.0246955 *
variety2	7.3667	2.5593	2.8784	0.0052049 **
variety3	4.7667	2.5593	1.8625	0.0664519 .
variety4	2.2833	2.5593	0.8922	0.3751569
variety5	0.0000	0.0000		
methoda:variety1	-6.4333	3.6194	-1.7775	0.0795479 .
methoda:variety2	-7.8500	3.6194	-2.1689	0.0332634 *
methoda:variety3	-3.9667	3.6194	-1.0959	0.2766108
methoda:variety4	1.3500	3.6194	0.3730	0.7102090
methoda:variety5	0.0000	0.0000		
methodb:variety1	-10.0000	3.6194	-2.7629	0.0072031 **
methodb:variety2	-11.3500	3.6194	-3.1359	0.0024473 **
methodb:variety3	-8.5333	3.6194	-2.3577	0.0210000 *
methodb:variety4	-8.0000	3.6194	-2.2103	0.0301340 *
methodb:variety5	0.0000	0.0000		
methodc:variety1	0.0000	0.0000		
methodc:variety2	0.0000	0.0000		
methodc:variety3	0.0000	0.0000		
methodc:variety4	0.0000	0.0000		
methodc:variety5	0.0000	0.0000		

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

## 5.3 Chapter 4

### 5.3.1 p94

(26) MODEL

```

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

```

\$ANOVA

Response : logct

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

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

```

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

```

### 5.3.2 p116

(27) MODEL

```
GLM(Y ~ method + variety + method:variety, p751) # 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	t value	Pr(> t )
(Intercept)	12.5500	1.8097	6.9348	1.23e-09 ***
methoda	9.7833	2.5593	3.8226	0.0002707 ***
methodb	6.6667	2.5593	2.6049	0.0110772 *
methodc	0.0000	0.0000		
variety1	5.8667	2.5593	2.2923	0.0246955 *
variety2	7.3667	2.5593	2.8784	0.0052049 **
variety3	4.7667	2.5593	1.8625	0.0664519 .
variety4	2.2833	2.5593	0.8922	0.3751569
variety5	0.0000	0.0000		
methoda:variety1	-6.4333	3.6194	-1.7775	0.0795479 .
methoda:variety2	-7.8500	3.6194	-2.1689	0.0332634 *
methoda:variety3	-3.9667	3.6194	-1.0959	0.2766108
methoda:variety4	1.3500	3.6194	0.3730	0.7102090
methoda:variety5	0.0000	0.0000		
methodb:variety1	-10.0000	3.6194	-2.7629	0.0072031 **
methodb:variety2	-11.3500	3.6194	-3.1359	0.0024473 **
methodb:variety3	-8.5333	3.6194	-2.3577	0.0210000 *
methodb:variety4	-8.0000	3.6194	-2.2103	0.0301340 *

```

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

```

### 5.3.3 p122

(28) MODEL

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```

---

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

\$Parameter

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

---

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

### 5.3.4 p136

(29) MODEL

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

\$ANOVA

Response : drywt

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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



```

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

```

## 5.4 Chapter 5

### 5.4.1 p142

(30) MODEL

```

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

```

```

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

```

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

```
$`Type I`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
STUDY	4	3553.9	888.46	2.9355	0.02638 *
TRT	1	66.0	66.04	0.2182	0.64185

```
---
```

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

```
$`Type II`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
STUDY	4	3599.4	899.85	2.9731	0.02496 *
TRT	1	66.0	66.04	0.2182	0.64185

```
---
```

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

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
STUDY	4	3599.4	899.85	2.9731	0.02496 *
TRT	1	66.0	66.04	0.2182	0.64185

```
---
```

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

```
$Parameter
```

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	20.7038	5.1627	4.0103	0.0001481 ***
STUDY42	18.8049	11.1730	1.6831	0.0967562 .
STUDY43	3.3539	5.8408	0.5742	0.5676300
STUDY44	-9.6707	7.1273	-1.3569	0.1791234
STUDY45	9.6932	6.0879	1.5922	0.1157835
STUDY46	0.0000	0.0000		
TRTA	-1.8583	3.9782	-0.4671	0.6418492
TRTB	0.0000	0.0000		

```
---
```

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

(31) MODEL

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

```
$ANOVA
```

```
Response : FLUSH
```

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

---

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

## 5.5 Chapter 6

### 5.5.1 p171

(32) MODEL

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

\$ANOVA

Response : score2

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

\$`Type I`

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

\$`Type II`

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

\$`Type III`

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

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	72.455	2.0097	36.0530	<2e-16 ***
teachJAY	3.545	3.3828	1.0481	0.3036
teachPAT	0.903	2.6855	0.3361	0.7393
teachROBIN	0.000	0.0000		

---

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

### 5.5.2 p188

(33) MODEL

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

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	5	63.711	12.7422	5.866	0.005724 **
RESIDUALS	12	26.067	2.1722		
CORRECTED TOTAL	17	89.778			

---

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
a	1	7.803	7.8028	3.5921	0.082395 .
b	2	20.492	10.2459	4.7168	0.030798 *
a:b	2	35.416	17.7082	8.1521	0.005807 **

---

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
a	1	15.850	15.850	7.2968	0.019265 *
b	2	20.492	10.246	4.7168	0.030798 *
a:b	2	35.416	17.708	8.1521	0.005807 **

---

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
a	1	9.641	9.6407	4.4382	0.056865 .
b	2	30.866	15.4330	7.1047	0.009212 **
a:b	2	35.416	17.7082	8.1521	0.005807 **

---

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

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	5.4000	0.65912	8.1927	2.944e-06 ***
a1	-4.4000	1.61452	-2.7253	0.018427 *
a2	0.0000	0.00000		
b1	-2.9000	1.23311	-2.3518	0.036594 *
b2	2.9333	1.07634	2.7253	0.018427 *
b3	0.0000	0.00000		
a1:b1	7.4000	2.18607	3.3851	0.005417 **
a1:b2	0.6667	1.94041	0.3436	0.737114
a1:b3	0.0000	0.00000		
a2:b1	0.0000	0.00000		
a2:b2	0.0000	0.00000		
a2:b3	0.0000	0.00000		

---

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

### 5.5.3 p203

(34) MODEL

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

\$ANOVA

Response : y

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

```

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

```

#### 5.5.4 p215

(35) MODEL

```

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

```

\$ANOVA

Response : yield

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

\$`Type I`

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

\$`Type II`

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

\$`Type III`

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

\$Parameter

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

---

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

*# Compare with SAS output*

(36) MODEL

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

\$ANOVA

Response : yield

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

\$`Type I`

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



\$`Type II`

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

\$`Type III`

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

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	30.6667	2.5609	11.9750	2.055e-05 ***
reps1	-1.7000	3.1364	-0.5420	0.6073
reps2	-0.8000	3.1364	-0.2551	0.8072
reps3	0.0000	0.0000		
irrig1	2.6333	3.6216	0.7271	0.4945
irrig2	3.5833	3.6216	0.9894	0.3607
irrig3	0.0000	0.0000		
reps1:irrig1	-3.2000	4.4356	-0.7214	0.4978
reps1:irrig2	-3.9000	4.4356	-0.8793	0.4131
reps1:irrig3	0.0000	0.0000		
reps2:irrig1	-0.7000	4.4356	-0.1578	0.8798
reps2:irrig2	-2.5500	4.4356	-0.5749	0.5863
reps2:irrig3	0.0000	0.0000		
reps3:irrig1	0.0000	0.0000		
reps3:irrig2	0.0000	0.0000		
reps3:irrig3	0.0000	0.0000		
cultA	0.3667	2.5609	0.1432	0.8908
cultB	0.0000	0.0000		
irrig1:cultA	-0.0667	3.6216	-0.0184	0.9859
irrig1:cultB	0.0000	0.0000		
irrig2:cultA	-0.0667	3.6216	-0.0184	0.9859
irrig2:cultB	0.0000	0.0000		
irrig3:cultA	0.0000	0.0000		
irrig3:cultB	0.0000	0.0000		

---

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

## 5.6 Chapter 7

### 5.6.1 p232

(37) MODEL

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

\$ANOVA

Response : final

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	5	354.45	70.889	235.05	5.493e-13 ***
RESIDUALS	14	4.22	0.302		
CORRECTED TOTAL	19	358.67			

---

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
trt	4	198.41	49.602	164.47	1.340e-11 ***
initial	1	156.04	156.040	517.38	1.867e-12 ***

---

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
trt	4	12.089	3.022	10.021	0.0004819 ***
initial	1	156.040	156.040	517.384	1.867e-12 ***

---

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
trt	4	12.089	3.022	10.021	0.0004819 ***
initial	1	156.040	156.040	517.384	1.867e-12 ***

---

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

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	2.49486	1.02786	2.4272	0.029298 *
trt1	-0.24446	0.57658	-0.4240	0.678022
trt2	-0.28027	0.49291	-0.5686	0.578630
trt3	1.65476	0.42943	3.8534	0.001756 **
trt4	1.10711	0.47175	2.3468	0.034170 *
trt5	0.00000	0.00000		
initial	1.08318	0.04762	22.7461	1.867e-12 ***

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

## 5.6.2 p240

(38) MODEL

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

\$ANOVA

Response : final

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

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

\$`Type I`

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

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

\$`Type II`

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

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

\$`Type III`

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

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

\$Parameter

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

trt1	5.6731	3.5715	1.5884	0.1433
trt2	-8.7175	8.9578	-0.9732	0.3534
trt3	5.2498	3.4875	1.5053	0.1632
trt4	4.7276	2.9399	1.6081	0.1389
trt5	0.0000	0.0000		
initial:trt1	-0.2412	0.1398	-1.7256	0.1151
initial:trt2	0.2775	0.3358	0.8263	0.4279
initial:trt3	-0.1678	0.1509	-1.1123	0.2920
initial:trt4	-0.1670	0.1269	-1.3153	0.2178
initial:trt5	0.0000	0.0000		

---

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

### 5.6.3 p241

(39) MODEL

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

\$ANOVA

Response : Q1

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

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

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

#### 5.6.4 p243

(40) MODEL

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

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

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

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

```
$`Type II`
```

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

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

```
$`Type III`
```

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

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

```
$Parameter
```

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	73.273	13.4837	5.4341	1.39e-05 ***
DAY1	-54.597	19.7355	-2.7664	0.0107321 *
DAY2	-34.786	20.2511	-1.7177	0.0987253 .
DAY3	-27.943	29.4284	-0.9495	0.3518193
DAY4	-24.123	21.3933	-1.1276	0.2706307
DAY5	4.626	30.6284	0.1510	0.8812016
DAY6	0.000	0.0000		
DAY1:P1	-0.220	0.2915	-0.7562	0.4568599
DAY2:P1	-0.624	0.2978	-2.0940	0.0470031 *
DAY3:P1	-0.611	0.5049	-1.2102	0.2379998
DAY4:P1	-0.796	0.3193	-2.4914	0.0200350 *
DAY5:P1	-1.196	0.5049	-2.3683	0.0262648 *
DAY6:P1	-1.225	0.2652	-4.6199	0.0001092 ***

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

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

	Estimate	Std. Error	t value	Pr(> t )
DAY1	18.675	14.4110	1.2959	0.2073286
DAY2	38.487	15.1094	2.5472	0.0176863 *
DAY3	45.330	26.1576	1.7329	0.0959384 .
DAY4	49.149	16.6092	2.9592	0.0068366 **
DAY5	77.899	27.5007	2.8326	0.0092034 **
DAY6	73.273	13.4837	5.4341	1.39e-05 ***
DAY1:P1	-0.220	0.2915	-0.7562	0.4568599
DAY2:P1	-0.624	0.2978	-2.0940	0.0470031 *
DAY3:P1	-0.611	0.5049	-1.2102	0.2379998

```
DAY4:P1    -0.796      0.3193 -2.4914 0.0200350 *
DAY5:P1    -1.196      0.5049 -2.3683 0.0262648 *
DAY6:P1    -1.225      0.2652 -4.6199 0.0001092 ***
```

---

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

(41) MODEL

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

\$ANOVA

Response : Q1

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

```

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

```

#### (42) MODEL

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

\$ANOVA

Response : Q1

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

```

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

```

\$`Type I`

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

```

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

```

\$`Type II`

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

```

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

```

\$`Type III`



```

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

```

```

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

```

## 5.6.5 p250

(43) MODEL

```

p250 = read.table("C:/G/Rt/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	t value	Pr(> t )
(Intercept)	-0.27244	0.119340	-2.2829	0.027825 *
bollwt	0.30561	0.020135	15.1781	< 2.2e-16 ***
variety37	0.42327	0.129645	3.2649	0.002249 **
variety213	0.00000	0.000000		
spacing30	0.03796	0.151615	0.2504	0.803596
spacing40	0.00000	0.000000		
variety37:spacing30	0.02364	0.198980	0.1188	0.906004
variety37:spacing40	0.00000	0.000000		
variety213:spacing30	0.00000	0.000000		
variety213:spacing40	0.00000	0.000000		
variety37:spacing30:plant0	0.00000	0.000000		
variety37:spacing30:plant3	0.08923	0.150334	0.5935	0.556164
variety37:spacing30:plant5	0.00000	0.000000		
variety37:spacing40:plant0	0.00000	0.000000		
variety37:spacing40:plant3	-0.02713	0.110857	-0.2447	0.807910
variety37:spacing40:plant5	0.00000	0.000000		

```

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

```

## 5.6.6 p254 Output 7.20

(44) MODEL

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

\$ANOVA

Response : lint

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	3	30.799	10.2665	201.65	< 2.2e-16 ***
RESIDUALS	45	2.291	0.0509		
CORRECTED TOTAL	48	33.091			

---

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
bollwt	1	29.0693	29.0693	570.9531	< 2.2e-16 ***
variety	1	1.2635	1.2635	24.8172	9.777e-06 ***
spacing	1	0.4666	0.4666	9.1655	0.004072 **

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

```
$Parameter
```

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

```
---
```

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

### 5.6.7 p256

(45) MODEL

```
p256 = read.table("C:/G/Rt/SAS41m/p256.txt", header=TRUE)
p256b = af(p256, c("bloc", "type", "logdose"))
GLM(y ~ bloc + type + logdose + type:logdose, p256b) # p258 Output 7.22
```

```
$ANOVA
```

```
Response : y
```

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

```
---
```

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

```
$`Type I`
```

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

```
---
```

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

```
$`Type II`
```

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

```
---
```

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

\$`Type III`

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

---

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

\$Parameter

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

---

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

### 5.6.8 p261 Output 7.27

(46) MODEL

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

\$ANOVA

Response : y

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

```

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

```

### 5.6.9 p262 Output 7.28

(47) MODEL

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

\$ANOVA

Response : y

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

---

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

## 5.7 Chapter 8

### 5.7.1 p269

(48) MODEL

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

\$ANOVA

Response : fev1

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

---

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

\$`Type I`

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

---

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

\$`Type II`



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

---

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

\$`Type III`

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

---

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

\$Parameter

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

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

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

---

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

## 5.8 Chapter 11

### 5.8.1 p390

(49) MODEL

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

\$ANOVA

Response : y

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	2.01062	0.25171	7.9879	6.627e-06 ***
rep1	0.32813	0.35597	0.9218	0.376420
rep2	-0.11000	0.35597	-0.3090	0.763085
rep3	0.00000	0.00000		
rep1:blk1	0.20000	0.38995	0.5129	0.618170
rep1:blk2	0.00000	0.00000		
rep2:blk1	0.87375	0.38995	2.2407	0.046645 *
rep2:blk2	0.00000	0.00000		
rep3:blk1	0.66875	0.38995	1.7150	0.114346
rep3:blk2	0.00000	0.00000		
ca	0.93708	0.09191	10.1955	6.090e-07 ***
cb	0.01375	0.09191	0.1496	0.883787
ca:cb	-0.26792	0.09191	-2.9149	0.014064 *
cc	1.25458	0.09191	13.6499	3.063e-08 ***
ca:cc	0.38062	0.11257	3.3813	0.006129 **
cb:cc	-0.84188	0.11257	-7.4788	1.232e-05 ***
ca:cb:cc	-0.04375	0.11257	-0.3887	0.704949

---

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

## 5.8.2 p394

(50) MODEL

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

\$ANOVA

Response : y

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

\$`Type I`

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

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

\$`Type II`

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

\$`Type III`

CAUTION: Singularity Exists !

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

```

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

```

(51) MODEL

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

```

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

```

```

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

```

a:b:c:d 0

\$`Type II`

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

\$`Type III`

CAUTION: Singularity Exists !

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

\$Parameter

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



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

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

### 5.8.3 p399

(52) MODEL

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

\$ANOVA

Response : y

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

---

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

\$`Type I`

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

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

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

```
$`Type II`
```

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

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

```
$`Type III`
```

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

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

```
$Parameter
```

```
              Estimate Std. Error  t value Pr(>|t|)
(Intercept)  19.1375     1.03732   18.4489 0.0003475 ***
trt1         -6.8250     0.92781   -7.3560 0.0051925 **
trt2         -5.9750     0.92781   -6.4399 0.0075922 **
trt3         -2.7000     0.92781   -2.9101 0.0619928 .
trt4          0.0000     0.00000    0.0000 1.0000000
blk1        -10.7875     1.03732  -10.3994 0.0018975 **
blk2         -9.9375     1.03732   -9.5799 0.0024133 **
blk3         -5.9750     1.03732   -5.7600 0.0103986 *
blk4         -4.2000     1.03732   -4.0489 0.0271308 *
blk5         -2.1750     1.13633   -1.9141 0.1515206
blk6          0.0000     0.00000    0.0000 1.0000000
---
```

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

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

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

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

```

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

```

(54) MODEL

```

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

```

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

Anova Table (Type III tests)

Response: HR

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

```

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

```

### 5.8.5 p409 11.5

(55) MODEL

```

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

```

\$ANOVA

Response : TS

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	5	258.727	51.745	263.71	1.785e-09 ***



```
RESIDUALS      9    1.766    0.196
CORRECTED TOTAL 14 260.493
```

```
---
```

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

```
$`Type I`
```

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

```
---
```

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

```
$`Type II`
```

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

```
---
```

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

```
$`Type III`
```

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

```
---
```

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

```
$Parameter
```

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

```
---
```

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

## 5.8.6 p412

(56) MODEL

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

\$ANOVA

Response : ts

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	3	393.01	131.002	903.34	< 2.2e-16 ***
RESIDUALS	16	2.32	0.145		
CORRECTED TOTAL	19	395.33			

---

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
source:amt	3	393.01	131	903.34	< 2.2e-16 ***

---

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
source:amt	3	393.01	131	903.34	< 2.2e-16 ***

---

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
source:amt	3	393.01	131	903.34	< 2.2e-16 ***

---

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

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	9.8824	0.136994	72.137	< 2.2e-16 ***
sourceA:amt	1.7230	0.063503	27.133	8.438e-15 ***
sourceB:amt	1.2375	0.063503	19.488	1.427e-12 ***
sourceC:amt	3.2430	0.063503	51.068	< 2.2e-16 ***

---

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

## 5.8.7 p414

(57) MODEL

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

\$ANOVA

Response : loglivcu

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

CAUTION: Singularity Exists !

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

---

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

\$Parameter

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

---

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

### 5.8.8 p417

(58) MODEL

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

\$ANOVA

Response : Y

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

```
TRT3:POT2    -1.0000    1.91954 -0.5210    0.61115
TRT3:POT3     0.0000    0.00000
```

```
---
```

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

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

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

Anova Table (Type III tests)

Response: Y

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

```
---
```

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

## 5.8.9 p431

(59) MODEL

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

\$ANOVA

Response : avdlygn

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

```
---
```

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

\$`Type I`

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

```
intltwt      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 **
intltwt	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 **
intltwt	1	0.26970	0.26970	5.3674	0.024830 *

```
---
```

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

```
$Parameter
```

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

```

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

```

---

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

*# p433 Output 11.40*

```

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

```

Note: model has aliased coefficients

sums of squares computed by model comparison

Anova Table (Type III tests)

Response: avdlygn

	Sum Sq	Df	F values	Pr(>F)
line	0.00000	0		
agedam	0.13011	2	1.2946	0.283392
age	0.38128	1	7.5878	0.008277 **
intlwt	0.26970	1	5.3674	0.024830 *
line:sire	0.97389	6	3.2303	0.009543 **

```
line:agedam 0.45343 4 2.2560 0.076821 .
Residuals 2.41192 48
```

```
---
```

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

(60) MODEL

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

```
$ANOVA
```

```
Response : avdlygn
```

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

```
---
```

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

```
$`Type I`
```

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

```
---
```

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

```
$`Type II`
```

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

```
---
```

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

```
$`Type III`
```

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

```
---
```

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

```
$Parameter
```

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	2.46347	0.096216	25.6036	< 2e-16 ***
sire1	-0.00739	0.128186	-0.0576	0.95427
sire2	-0.21429	0.128606	-1.6662	0.10146
sire3	-0.02260	0.146050	-0.1548	0.87759
sire4	-0.02364	0.128186	-0.1844	0.85440
sire5	0.12311	0.132193	0.9313	0.35585



sire6	-0.05290	0.138320	-0.3824	0.70364
sire7	-0.14760	0.129061	-1.1436	0.25782
sire8	-0.40781	0.135054	-3.0196	0.00386 **
sire9	0.00000	0.000000		
agedam3	0.11738	0.089117	1.3172	0.19334
agedam4	0.04830	0.077154	0.6260	0.53395
agedam5	0.00000	0.000000		

---

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

### 5.8.10 p437 ABSORB option in SAS

(61) MODEL

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

\$ANOVA

Response : avdlygn

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

---

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

\$`Type I`

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

---

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
line	0				
sire	6	0.97389	0.16231	3.2303	0.009543 **
agedam	2	0.33106	0.16553	3.2943	0.045640 *
line:agedam	4	0.45343	0.11336	2.2560	0.076821 .
age	1	0.38128	0.38128	7.5878	0.008277 **
intlwt	1	0.26970	0.26970	5.3674	0.024830 *

---

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

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
line	0				
sire	6	0.97389	0.16231	3.2303	0.009543 **
agedam	2	0.13011	0.06505	1.2946	0.283392
line:agedam	4	0.45343	0.11336	2.2560	0.076821 .
age	1	0.38128	0.38128	7.5878	0.008277 **
intlwt	1	0.26970	0.26970	5.3674	0.024830 *

---

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

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	2.99627	0.51285	5.8423	4.361e-07 ***
line1	0.07182	0.14551	0.4936	0.623826
line2	0.25247	0.13717	1.8406	0.071867 .
line3	0.00000	0.00000		
sire1	0.08573	0.13028	0.6580	0.513652
sire2	-0.12171	0.13622	-0.8934	0.376079
sire3	0.00000	0.00000		
sire4	-0.24460	0.12669	-1.9307	0.059443 .
sire5	0.00000	0.00000		
sire6	0.10540	0.12909	0.8165	0.418267
sire7	-0.01952	0.12038	-0.1622	0.871856
sire8	-0.33024	0.12567	-2.6278	0.011504 *
sire9	0.00000	0.00000		
agedam3	0.37039	0.11456	3.2332	0.002216 **
agedam4	0.27546	0.10378	2.6544	0.010746 *
agedam5	0.00000	0.00000		
line1:agedam3	-0.44894	0.19581	-2.2927	0.026291 *
line1:agedam4	-0.28283	0.16085	-1.7584	0.085062 .
line1:agedam5	0.00000	0.00000		
line2:agedam3	-0.26078	0.19529	-1.3354	0.188050
line2:agedam4	-0.35026	0.17439	-2.0085	0.050232 .
line2:agedam5	0.00000	0.00000		
line3:agedam3	0.00000	0.00000		
line3:agedam4	0.00000	0.00000		
line3:agedam5	0.00000	0.00000		
age	-0.00853	0.00310	-2.7546	0.008277 **
intlwt	0.00203	0.00087	2.3168	0.024830 *

---

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

# p437 Output 11.43

## 6 Sahai - Unbalanced

### Reference

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

### 6.1 Table 11.2

(62) MODEL

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

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	4	80.401	20.1003	5.9884	0.0004103 ***
RESIDUALS	59	198.036	3.3565		
CORRECTED TOTAL	63	278.438			

---

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group	4	80.401	20.1	5.9884	0.0004103 ***

---

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group	4	80.401	20.1	5.9884	0.0004103 ***

---

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group	4	80.401	20.1	5.9884	0.0004103 ***

---

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

\$Parameter

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

```

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

```

## 6.2 Table 12.6

(63) MODEL

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```

```

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

```

### 6.3 Table 13.6

(64) MODEL

```

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

```

```

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

```

```

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

```

```

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

```

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

```
$`Type III`
```

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

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

```
$Parameter
```

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

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

## 6.4 Table 14.2

(65) MODEL

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

```
$ANOVA
```

Response : Y

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

---

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

## 6.5 Table 15.3

(66) MODEL

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

\$ANOVA

Response : pH

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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



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

```

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

```

```

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

```

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

Anova Table (Type III tests)

```

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

```

## 6.6 Table 16.3

(67) MODEL

```

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

```

```

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

$`Type I`

```

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

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

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

---

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

(68) MODEL

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

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	27	4905.7	181.694	10.75	1.994e-10 ***
RESIDUALS	36	608.5	16.902		
CORRECTED TOTAL	63	5514.2			

---

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	223.8	74.60	4.4138	0.00963 **
A	3	194.6	64.85	3.8370	0.01756 *
R:A	9	158.2	17.58	1.0402	0.42842
B	3	4107.4	1369.13	81.0030	4.441e-16 ***
A:B	9	221.7	24.64	1.4577	0.20117

---

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	223.8	74.60	4.4138	0.00963 **
A	3	194.6	64.85	3.8370	0.01756 *
R:A	9	158.2	17.58	1.0402	0.42842
B	3	4107.4	1369.13	81.0030	4.441e-16 ***
A:B	9	221.7	24.64	1.4577	0.20117

---

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

\$`Type III`

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

```

R    3  223.8   74.60  4.4138   0.00963 **
A    3  194.6   64.85  3.8370   0.01756 *
R:A  9  158.2   17.58  1.0402   0.42842
B    3 4107.4 1369.13 81.0030 4.441e-16 ***
A:B  9  221.7   24.64  1.4577   0.20117

```

---

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

\$Parameter

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



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

---

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

## 7.2 Example 1.2

(69) MODEL

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

\$ANOVA

Response : Y

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

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

---

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

### 7.3 Example 2.1

(70) MODEL

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

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

\$ANOVA

Response : Y

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

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

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

---

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

## 7.4 Example 2.2

(71) MODEL

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

\$ANOVA

Response : Y

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

\$`Type I`

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

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

\$`Type II`

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

\$`Type III`

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

\$Parameter

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

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



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

---

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

(72) MODEL

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

\$ANOVA

Response : Y

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

\$`Type I`

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

\$`Type II`

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

\$`Type III`

CAUTION: Singularity Exists !

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

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

\$Parameter

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

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

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

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

(73) MODEL

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

```
$ANOVA
```

```
Response : Y
```

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

```
$`Type I`
```

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

```
$`Type II`
```

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

```
$`Type III`
```

```
CAUTION: Singularity Exists !
```

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

```
$Parameter
```

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

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

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



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

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

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

## 7.5 Example 3.1

(74) MODEL

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

\$ANOVA

Response : Yield

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

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

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

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

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



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

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

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

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

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

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

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

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

---

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

(75) MODEL

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

\$ANOVA

Response : height



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

\$`Type I`

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

\$`Type II`

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

\$`Type III`

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

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

\$Parameter

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

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

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

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

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

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

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



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

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

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

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

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

(76) MODEL

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

\$ANOVA

Response : height

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

\$`Type I`

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

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

\$`Type II`

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

\$`Type III`

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

\$Parameter

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

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

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



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

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

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

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

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

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

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

```
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
```

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



```

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

```

---

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

(78) MODEL

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

\$ANOVA

Response : yield

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

```

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

```

---

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

\$`Type III`

CAUTION: Singularity Exists !

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

---

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

\$Parameter

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

```

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

```

```
---
```

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

```

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

```

Note: model has aliased coefficients

sums of squares computed by model comparison

Anova Table (Type III tests)

Response: yield

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

---

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

## 7.6 Example 4.1

(79) MODEL

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

\$ANOVA

Response : height

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

\$`Type I`

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

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

\$`Type II`

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

\$`Type III`

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

\$Parameter

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

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

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

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



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

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

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

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

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

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

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

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



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

(80) MODEL

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

\$ANOVA

Response : height

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

\$`Type I`

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

\$`Type II`

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

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

```
$`Type III`
```

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

```
$Parameter
```

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

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

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

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

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

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

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



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

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

## 7.7 Example 5.1

(81) MODEL

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

\$ANOVA

Response : Y

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

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

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

---

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

(82) MODEL

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

\$ANOVA

Response : Y

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

```

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

```

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

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

---

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

\$Parameter

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

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

---

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

(83) MODEL

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

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	24	196.238	8.1766	7.0476	0.0008758 ***
RESIDUALS	11	12.762	1.1602		
CORRECTED TOTAL	35	209.000			

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

CAUTION: Singularity Exists !

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

---

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

\$Parameter

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



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

---

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

```
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	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

(84) MODEL

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

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	28	204.2	7.2929	10.635	0.001719 **
RESIDUALS	7	4.8	0.6857		
CORRECTED TOTAL	35	209.0			

---

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

\$`Type I`

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

---

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

\$`Type II`

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

---

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

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	28.112	14.0562	20.4986	0.0011846 **
A	1	14.655	14.6551	21.3720	0.0024176 **
R:A	1	2.017	2.0174	2.9420	0.1300172
C	2	0.471	0.2356	0.3436	0.7205632
B	1	1.769	1.7694	2.5804	0.1522328
C:B	1	0.644	0.6445	0.9399	0.3646045
Tx	5	103.815	20.7630	30.2793	0.0001336 ***
A:Tx	4	2.951	0.7378	1.0760	0.4358837
B:Tx	4	3.553	0.8882	1.2954	0.3579988
A:B:Tx	4	7.962	1.9905	2.9029	0.1038803

---

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

\$Parameter

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

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

---

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

```
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

(85) MODEL

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

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	95	577.83	6.0824	5.3082	1.068e-05 ***
RESIDUALS	24	27.50	1.1458		
CORRECTED TOTAL	119	605.33			

---

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

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	84.76	28.2528	24.6570	1.655e-07 ***
G	27	343.48	12.7216	11.1025	4.286e-08 ***
R:G	9	11.75	1.3056	1.1394	0.3749
F	2	59.85	29.9250	26.1164	9.481e-07 ***
G:F	54	77.98	1.4441	1.2603	0.2718

---

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

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	5.75	1.9167	1.6727	0.1994
G	27	343.48	12.7216	11.1025	4.286e-08 ***
R:G	9	11.75	1.3056	1.1394	0.3749
F	2	59.85	29.9250	26.1164	9.481e-07 ***
G:F	54	77.98	1.4441	1.2603	0.2718

---

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

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	5.75	1.9167	1.6727	0.1994
G	27	343.48	12.7216	11.1025	4.286e-08 ***
R:G	9	11.75	1.3056	1.1394	0.3749
F	2	50.51	25.2525	22.0385	3.686e-06 ***
G:F	54	77.98	1.4441	1.2603	0.2718

---

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

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

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



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

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

G15:F1	-3.0000	1.69251	-1.7725	0.0890040	.
G15:F2	-1.0000	1.69251	-0.5908	0.5601518	
G15:F3	0.0000	0.00000			
G16:F1	-2.0000	1.69251	-1.1817	0.2489103	
G16:F2	-2.0000	1.69251	-1.1817	0.2489103	
G16:F3	0.0000	0.00000			
G17:F1	-2.0000	1.69251	-1.1817	0.2489103	
G17:F2	0.0000	1.69251	0.0000	1.0000000	
G17:F3	0.0000	0.00000			
G18:F1	-3.0000	1.69251	-1.7725	0.0890040	.
G18:F2	-1.0000	1.69251	-0.5908	0.5601518	
G18:F3	0.0000	0.00000			
G19:F1	-4.0000	1.69251	-2.3634	0.0265504	*
G19:F2	-1.0000	1.69251	-0.5908	0.5601518	
G19:F3	0.0000	0.00000			
G20:F1	-2.0000	1.69251	-1.1817	0.2489103	
G20:F2	-2.0000	1.69251	-1.1817	0.2489103	
G20:F3	0.0000	0.00000			
G21:F1	-1.0000	1.69251	-0.5908	0.5601518	
G21:F2	-4.0000	1.69251	-2.3634	0.0265504	*
G21:F3	0.0000	0.00000			
G22:F1	-1.0000	1.69251	-0.5908	0.5601518	
G22:F2	-2.0000	1.69251	-1.1817	0.2489103	
G22:F3	0.0000	0.00000			
G23:F1	0.0000	1.69251	0.0000	1.0000000	
G23:F2	-1.0000	1.69251	-0.5908	0.5601518	
G23:F3	0.0000	0.00000			
G24:F1	0.0000	1.69251	0.0000	1.0000000	
G24:F2	-1.0000	1.69251	-0.5908	0.5601518	
G24:F3	0.0000	0.00000			
G25:F1	-3.5000	1.07044	-3.2697	0.0032428	**
G25:F2	-2.2500	1.07044	-2.1019	0.0462352	*
G25:F3	0.0000	0.00000			
G26:F1	-2.7500	1.07044	-2.5690	0.0168399	*
G26:F2	-2.2500	1.07044	-2.1019	0.0462352	*
G26:F3	0.0000	0.00000			
G27:F1	0.0000	1.07044	0.0000	1.0000000	
G27:F2	-0.2500	1.07044	-0.2335	0.8173152	
G27:F3	0.0000	0.00000			
G28:F1	0.0000	0.00000			
G28:F2	0.0000	0.00000			
G28:F3	0.0000	0.00000			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

```
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(Y ~ R + G + R:G + F + F:G, ex7.1), type=3, singular.ok=TRUE) # NOT OK
```

Note: model has aliased coefficients  
 sums of squares computed by model comparison

Anova Table (Type III tests)

Response: Y

	Sum Sq	Df	F values	Pr(>F)
R	0.000	0		
G	202.417	3	58.8848	3.258e-11 ***
F	50.505	2	22.0385	3.686e-06 ***
R:G	11.750	9	1.1394	0.3749
G:F	77.983	54	1.2603	0.2718
Residuals	27.500	24		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 7.9 Example 7.2

(86) MODEL

```
ex7.2 = read.table("C:/G/Rt/Split/aspedt.txt", header=TRUE)
ex7.2 = af(ex7.2, c("R", "T", "G"))
GLM(Y ~ R + T + R:T + G + G:T, ex7.2)
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	99	538.70	5.4415	5.1892	1.286e-05 ***
RESIDUALS	24	25.17	1.0486		
CORRECTED TOTAL	123	563.87			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	73.255	24.4183	23.2863	2.752e-07 ***
T	3	32.000	10.6667	10.1722	0.0001645 ***
R:T	9	28.402	3.1558	3.0095	0.0149568 *
G	21	309.908	14.7575	14.0734	7.158e-09 ***
T:G	63	95.140	1.5102	1.4401	0.1617931

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	4.229	1.4097	1.3444	0.2834998

```

T      3  32.000 10.6667 10.1722 0.0001645 ***
R:T    9  10.854  1.2060  1.1501 0.3684706
G     21 309.908 14.7575 14.0734 7.158e-09 ***
T:G   63  95.140  1.5102  1.4401 0.1617931

```

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	4.229	1.4097	1.3444	0.283500
T	3	22.668	7.5559	7.2056	0.001299 **
R:T	9	10.854	1.2060	1.1501	0.368471
G	21	309.908	14.7575	14.0734	7.158e-09 ***
T:G	63	95.140	1.5102	1.4401	0.161793

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	7.0833	0.72409	9.7824	7.541e-10 ***
R1	-0.6667	0.83611	-0.7973	0.433068
R2	-0.3333	0.83611	-0.3987	0.693659
R3	-1.3333	0.83611	-1.5947	0.123867
R4	0.0000	0.00000		
T1	0.3333	1.02402	0.3255	0.747612
T2	1.5833	1.02402	1.5462	0.135143
T3	0.0833	1.02402	0.0814	0.935816
T4	0.0000	0.00000		
R1:T1	-0.6667	1.18243	-0.5638	0.578115
R1:T2	0.3333	1.18243	0.2819	0.780433
R1:T3	1.6667	1.18243	1.4095	0.171508
R1:T4	0.0000	0.00000		
R2:T1	0.3333	1.18243	0.2819	0.780433
R2:T2	0.0000	1.18243	0.0000	1.000000
R2:T3	-0.6667	1.18243	-0.5638	0.578115
R2:T4	0.0000	0.00000		
R3:T1	1.0000	1.18243	0.8457	0.406066
R3:T2	0.3333	1.18243	0.2819	0.780433
R3:T3	0.6667	1.18243	0.5638	0.578115
R3:T4	0.0000	0.00000		
R4:T1	0.0000	0.00000		
R4:T2	0.0000	0.00000		
R4:T3	0.0000	0.00000		
R4:T4	0.0000	0.00000		
G1	-3.4167	1.25416	-2.7243	0.011829 *
G2	-2.4167	1.25416	-1.9269	0.065909 .
G3	-1.4167	1.25416	-1.1296	0.269819
G4	-4.4167	1.25416	-3.5216	0.001746 **

G5	-2.4167	1.25416	-1.9269	0.065909	.
G6	-1.7500	1.25416	-1.3954	0.175687	
G7	-2.7500	1.25416	-2.1927	0.038261	*
G8	-1.7500	1.25416	-1.3954	0.175687	
G9	0.2500	1.25416	0.1993	0.843679	
G10	0.2500	1.25416	0.1993	0.843679	
G11	0.2500	1.25416	0.1993	0.843679	
G12	0.2500	1.25416	0.1993	0.843679	
G13	-1.7500	1.25416	-1.3954	0.175687	
G14	-3.7500	1.25416	-2.9900	0.006354	**
G15	1.2500	1.25416	0.9967	0.328862	
G16	-1.0833	1.25416	-0.8638	0.396253	
G17	-1.0833	1.25416	-0.8638	0.396253	
G18	-0.0833	1.25416	-0.0664	0.947574	
G19	0.9167	1.25416	0.7309	0.471916	
G20	-1.0000	0.72409	-1.3810	0.179990	
G21	-2.2500	0.72409	-3.1074	0.004802	**
G22	0.0000	0.00000			
T1:G1	5.3333	1.77365	3.0070	0.006104	**
T1:G2	3.3333	1.77365	1.8794	0.072391	.
T1:G3	1.3333	1.77365	0.7517	0.459513	
T1:G4	3.3333	1.77365	1.8794	0.072391	.
T1:G5	5.3333	1.77365	3.0070	0.006104	**
T1:G6	-2.6667	1.77365	-1.5035	0.145759	
T1:G7	-1.6667	1.77365	-0.9397	0.356743	
T1:G8	-1.6667	1.77365	-0.9397	0.356743	
T1:G9	-3.6667	1.77365	-2.0673	0.049653	*
T1:G10	1.3333	1.77365	0.7517	0.459513	
T1:G11	1.6667	1.77365	0.9397	0.356743	
T1:G12	1.6667	1.77365	0.9397	0.356743	
T1:G13	-4.3333	1.77365	-2.4432	0.022292	*
T1:G14	-1.3333	1.77365	-0.7517	0.459513	
T1:G15	0.6667	1.77365	0.3759	0.710313	
T1:G16	2.6667	1.77365	1.5035	0.145759	
T1:G17	2.6667	1.77365	1.5035	0.145759	
T1:G18	1.6667	1.77365	0.9397	0.356743	
T1:G19	0.6667	1.77365	0.3759	0.710313	
T1:G20	1.0000	1.02402	0.9765	0.338535	
T1:G21	1.0000	1.02402	0.9765	0.338535	
T1:G22	0.0000	0.00000			
T2:G1	4.0833	1.77365	2.3022	0.030304	*
T2:G2	2.0833	1.77365	1.1746	0.251677	
T2:G3	-1.9167	1.77365	-1.0806	0.290600	
T2:G4	1.0833	1.77365	0.6108	0.547078	
T2:G5	2.0833	1.77365	1.1746	0.251677	
T2:G6	-3.5833	1.77365	-2.0203	0.054646	.
T2:G7	-3.5833	1.77365	-2.0203	0.054646	.
T2:G8	-4.5833	1.77365	-2.5841	0.016278	*

T2:G9	-3.5833	1.77365	-2.0203	0.054646	.
T2:G10	-1.5833	1.77365	-0.8927	0.380883	
T2:G11	1.0833	1.77365	0.6108	0.547078	
T2:G12	-0.9167	1.77365	-0.5168	0.610008	
T2:G13	-3.9167	1.77365	-2.2083	0.037026	*
T2:G14	-2.9167	1.77365	-1.6444	0.113121	
T2:G15	0.0833	1.77365	0.0470	0.962915	
T2:G16	0.4167	1.77365	0.2349	0.816263	
T2:G17	1.4167	1.77365	0.7987	0.432281	
T2:G18	-1.5833	1.77365	-0.8927	0.380883	
T2:G19	-3.5833	1.77365	-2.0203	0.054646	.
T2:G20	1.2500	1.02402	1.2207	0.234064	
T2:G21	-1.0000	1.02402	-0.9765	0.338535	
T2:G22	0.0000	0.00000			
T3:G1	0.2500	1.77365	0.1410	0.889084	
T3:G2	0.2500	1.77365	0.1410	0.889084	
T3:G3	0.2500	1.77365	0.1410	0.889084	
T3:G4	0.2500	1.77365	0.1410	0.889084	
T3:G5	0.2500	1.77365	0.1410	0.889084	
T3:G6	-1.4167	1.77365	-0.7987	0.432281	
T3:G7	-0.4167	1.77365	-0.2349	0.816263	
T3:G8	-1.4167	1.77365	-0.7987	0.432281	
T3:G9	-0.4167	1.77365	-0.2349	0.816263	
T3:G10	0.5833	1.77365	0.3289	0.745093	
T3:G11	0.2500	1.77365	0.1410	0.889084	
T3:G12	0.2500	1.77365	0.1410	0.889084	
T3:G13	-1.7500	1.77365	-0.9867	0.333650	
T3:G14	-0.7500	1.77365	-0.4229	0.676165	
T3:G15	0.2500	1.77365	0.1410	0.889084	
T3:G16	0.9167	1.77365	0.5168	0.610008	
T3:G17	0.9167	1.77365	0.5168	0.610008	
T3:G18	1.9167	1.77365	1.0806	0.290600	
T3:G19	0.9167	1.77365	0.5168	0.610008	
T3:G20	0.5000	1.02402	0.4883	0.629788	
T3:G21	0.2500	1.02402	0.2441	0.809200	
T3:G22	0.0000	0.00000			
T4:G1	0.0000	0.00000			
T4:G2	0.0000	0.00000			
T4:G3	0.0000	0.00000			
T4:G4	0.0000	0.00000			
T4:G5	0.0000	0.00000			
T4:G6	0.0000	0.00000			
T4:G7	0.0000	0.00000			
T4:G8	0.0000	0.00000			
T4:G9	0.0000	0.00000			
T4:G10	0.0000	0.00000			
T4:G11	0.0000	0.00000			
T4:G12	0.0000	0.00000			

T4:G13	0.0000	0.00000
T4:G14	0.0000	0.00000
T4:G15	0.0000	0.00000
T4:G16	0.0000	0.00000
T4:G17	0.0000	0.00000
T4:G18	0.0000	0.00000
T4:G19	0.0000	0.00000
T4:G20	0.0000	0.00000
T4:G21	0.0000	0.00000
T4:G22	0.0000	0.00000

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 7.10 Example 7.3

(87) MODEL

```
ex7.3 = read.table("C:/G/Rt/Split/assped.txt", header=TRUE)
ex7.3 = af(ex7.3, c("R", "T", "G", "F"))
GLM(Y ~ R + T + R:T + G + G:T + R:T:G + F + F:T + F:G + F:G:T, ex7.3)
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	155	656.12	4.2330	13.446	3.997e-14 ***
RESIDUALS	36	11.33	0.3148		
CORRECTED TOTAL	191	667.45			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	27.06	9.019	28.6489	1.203e-09 ***
T	1	10.55	10.547	33.5018	1.334e-06 ***
R:T	3	2.97	0.991	3.1489	0.036705 *
G	22	389.01	17.682	56.1668	< 2.2e-16 ***
T:G	22	18.42	0.837	2.6601	0.004445 **
R:T:G	12	8.78	0.731	2.3235	0.025315 *
F	2	164.28	82.141	260.9173	< 2.2e-16 ***
T:F	2	0.84	0.422	1.3401	0.274574
G:F	44	23.47	0.533	1.6943	0.053191 .
T:G:F	44	10.74	0.244	0.7753	0.790640

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`



	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	12.49	4.162	13.2206	5.655e-06 ***
T	1	10.55	10.547	33.5018	1.334e-06 ***
R:T	3	1.15	0.384	1.2206	0.316281
G	22	389.01	17.682	56.1668	< 2.2e-16 ***
T:G	22	18.42	0.837	2.6601	0.004445 **
R:T:G	12	8.78	0.731	2.3235	0.025315 *
F	2	164.28	82.141	260.9173	< 2.2e-16 ***
T:F	2	0.84	0.422	1.3401	0.274574
G:F	44	23.47	0.533	1.6943	0.053191 .
T:G:F	44	10.74	0.244	0.7753	0.790640

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	12.49	4.162	13.2206	5.655e-06 ***
T	1	11.16	11.158	35.4430	8.021e-07 ***
R:T	3	1.15	0.384	1.2206	0.316281
G	22	389.01	17.682	56.1668	< 2.2e-16 ***
T:G	22	18.42	0.837	2.6601	0.004445 **
R:T:G	12	8.78	0.731	2.3235	0.025315 *
F	2	120.56	60.282	191.4828	< 2.2e-16 ***
T:F	2	0.82	0.411	1.3060	0.283432
G:F	44	23.47	0.533	1.6943	0.053191 .
T:G:F	44	10.74	0.244	0.7753	0.790640

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	9.0000	0.39675	22.6845	< 2.2e-16 ***
R1	-1.0000	0.45812	-2.1828	0.0356525 *
R2	-1.0000	0.45812	-2.1828	0.0356525 *
R3	0.0000	0.45812	0.0000	1.0000000
R4	0.0000	0.00000		
T1	-0.2500	0.56108	-0.4456	0.6585786
T2	0.0000	0.00000		
R1:T1	0.3333	0.64788	0.5145	0.6100498
R1:T2	0.0000	0.00000		
R2:T1	0.6667	0.64788	1.0290	0.3103479
R2:T2	0.0000	0.00000		
R3:T1	0.0000	0.64788	0.0000	1.0000000
R3:T2	0.0000	0.00000		
R4:T1	0.0000	0.00000		
R4:T2	0.0000	0.00000		
G1	-3.0000	0.68718	-4.3656	0.0001024 ***
G2	0.0000	0.68718	0.0000	1.0000000

G3	1.0000	0.68718	1.4552	0.1542753	
G4	1.0000	0.68718	1.4552	0.1542753	
G5	1.0000	0.68718	1.4552	0.1542753	
G6	-1.0000	0.68718	-1.4552	0.1542753	
G7	-1.0000	0.68718	-1.4552	0.1542753	
G8	0.0000	0.68718	0.0000	1.0000000	
G9	1.0000	0.68718	1.4552	0.1542753	
G10	-1.0000	0.68718	-1.4552	0.1542753	
G11	-3.0000	0.68718	-4.3656	0.0001024	***
G12	0.0000	0.68718	0.0000	1.0000000	
G13	0.0000	0.68718	0.0000	1.0000000	
G14	-1.0000	0.68718	-1.4552	0.1542753	
G15	-2.0000	0.68718	-2.9104	0.0061560	**
G16	-5.0000	0.68718	-7.2761	1.431e-08	***
G17	-3.0000	0.68718	-4.3656	0.0001024	***
G18	-2.0000	0.68718	-2.9104	0.0061560	**
G19	-2.0000	0.68718	-2.9104	0.0061560	**
G20	-1.0000	0.68718	-1.4552	0.1542753	
G21	-2.0000	0.56108	-3.5645	0.0010508	**
G22	-0.3333	0.56108	-0.5941	0.5561681	
G23	0.0000	0.00000			
T1:G1	0.9167	0.97183	0.9432	0.3518445	
T1:G2	-1.0833	0.97183	-1.1147	0.2723483	
T1:G3	-0.0833	0.97183	-0.0857	0.9321409	
T1:G4	-0.0833	0.97183	-0.0857	0.9321409	
T1:G5	-0.0833	0.97183	-0.0857	0.9321409	
T1:G6	-1.4167	0.97183	-1.4577	0.1535818	
T1:G7	0.5833	0.97183	0.6002	0.5521031	
T1:G8	0.5833	0.97183	0.6002	0.5521031	
T1:G9	-0.4167	0.97183	-0.4287	0.6706625	
T1:G10	-1.4167	0.97183	-1.4577	0.1535818	
T1:G11	0.2500	0.97183	0.2572	0.7984521	
T1:G12	-0.7500	0.97183	-0.7717	0.4453029	
T1:G13	-1.7500	0.97183	-1.8007	0.0801274	.
T1:G14	1.2500	0.97183	1.2862	0.2065706	
T1:G15	-2.7500	0.97183	-2.8297	0.0075715	**
T1:G16	1.2500	0.97183	1.2862	0.2065706	
T1:G17	-0.7500	0.97183	-0.7717	0.4453029	
T1:G18	-0.7500	0.97183	-0.7717	0.4453029	
T1:G19	0.2500	0.97183	0.2572	0.7984521	
T1:G20	-0.7500	0.97183	-0.7717	0.4453029	
T1:G21	1.1667	0.79349	1.4703	0.1501689	
T1:G22	-1.0000	0.79349	-1.2603	0.2156865	
T1:G23	0.0000	0.00000			
T2:G1	0.0000	0.00000			
T2:G2	0.0000	0.00000			
T2:G3	0.0000	0.00000			
T2:G4	0.0000	0.00000			

T2:G5	0.0000	0.00000		
T2:G6	0.0000	0.00000		
T2:G7	0.0000	0.00000		
T2:G8	0.0000	0.00000		
T2:G9	0.0000	0.00000		
T2:G10	0.0000	0.00000		
T2:G11	0.0000	0.00000		
T2:G12	0.0000	0.00000		
T2:G13	0.0000	0.00000		
T2:G14	0.0000	0.00000		
T2:G15	0.0000	0.00000		
T2:G16	0.0000	0.00000		
T2:G17	0.0000	0.00000		
T2:G18	0.0000	0.00000		
T2:G19	0.0000	0.00000		
T2:G20	0.0000	0.00000		
T2:G21	0.0000	0.00000		
T2:G22	0.0000	0.00000		
T2:G23	0.0000	0.00000		
R1:T1:G1	0.0000	0.00000		
R1:T1:G2	0.0000	0.00000		
R1:T1:G3	0.0000	0.00000		
R1:T1:G4	0.0000	0.00000		
R1:T1:G5	0.0000	0.00000		
R1:T1:G6	0.0000	0.00000		
R1:T1:G7	0.0000	0.00000		
R1:T1:G8	0.0000	0.00000		
R1:T1:G9	0.0000	0.00000		
R1:T1:G10	0.0000	0.00000		
R1:T1:G11	0.0000	0.00000		
R1:T1:G12	0.0000	0.00000		
R1:T1:G13	0.0000	0.00000		
R1:T1:G14	0.0000	0.00000		
R1:T1:G15	0.0000	0.00000		
R1:T1:G16	0.0000	0.00000		
R1:T1:G17	0.0000	0.00000		
R1:T1:G18	0.0000	0.00000		
R1:T1:G19	0.0000	0.00000		
R1:T1:G20	0.0000	0.00000		
R1:T1:G21	-1.0000	0.64788	-1.5435	0.1314585
R1:T1:G22	0.0000	0.64788	0.0000	1.0000000
R1:T1:G23	0.0000	0.00000		
R1:T2:G1	0.0000	0.00000		
R1:T2:G2	0.0000	0.00000		
R1:T2:G3	0.0000	0.00000		
R1:T2:G4	0.0000	0.00000		
R1:T2:G5	0.0000	0.00000		
R1:T2:G6	0.0000	0.00000		

R1:T2:G7	0.0000	0.00000		
R1:T2:G8	0.0000	0.00000		
R1:T2:G9	0.0000	0.00000		
R1:T2:G10	0.0000	0.00000		
R1:T2:G11	0.0000	0.00000		
R1:T2:G12	0.0000	0.00000		
R1:T2:G13	0.0000	0.00000		
R1:T2:G14	0.0000	0.00000		
R1:T2:G15	0.0000	0.00000		
R1:T2:G16	0.0000	0.00000		
R1:T2:G17	0.0000	0.00000		
R1:T2:G18	0.0000	0.00000		
R1:T2:G19	0.0000	0.00000		
R1:T2:G20	0.0000	0.00000		
R1:T2:G21	0.6667	0.64788	1.0290	0.3103479
R1:T2:G22	0.0000	0.64788	0.0000	1.0000000
R1:T2:G23	0.0000	0.00000		
R2:T1:G1	0.0000	0.00000		
R2:T1:G2	0.0000	0.00000		
R2:T1:G3	0.0000	0.00000		
R2:T1:G4	0.0000	0.00000		
R2:T1:G5	0.0000	0.00000		
R2:T1:G6	0.0000	0.00000		
R2:T1:G7	0.0000	0.00000		
R2:T1:G8	0.0000	0.00000		
R2:T1:G9	0.0000	0.00000		
R2:T1:G10	0.0000	0.00000		
R2:T1:G11	0.0000	0.00000		
R2:T1:G12	0.0000	0.00000		
R2:T1:G13	0.0000	0.00000		
R2:T1:G14	0.0000	0.00000		
R2:T1:G15	0.0000	0.00000		
R2:T1:G16	0.0000	0.00000		
R2:T1:G17	0.0000	0.00000		
R2:T1:G18	0.0000	0.00000		
R2:T1:G19	0.0000	0.00000		
R2:T1:G20	0.0000	0.00000		
R2:T1:G21	-1.0000	0.64788	-1.5435	0.1314585
R2:T1:G22	-0.3333	0.64788	-0.5145	0.6100498
R2:T1:G23	0.0000	0.00000		
R2:T2:G1	0.0000	0.00000		
R2:T2:G2	0.0000	0.00000		
R2:T2:G3	0.0000	0.00000		
R2:T2:G4	0.0000	0.00000		
R2:T2:G5	0.0000	0.00000		
R2:T2:G6	0.0000	0.00000		
R2:T2:G7	0.0000	0.00000		
R2:T2:G8	0.0000	0.00000		

R2:T2:G9	0.0000	0.00000		
R2:T2:G10	0.0000	0.00000		
R2:T2:G11	0.0000	0.00000		
R2:T2:G12	0.0000	0.00000		
R2:T2:G13	0.0000	0.00000		
R2:T2:G14	0.0000	0.00000		
R2:T2:G15	0.0000	0.00000		
R2:T2:G16	0.0000	0.00000		
R2:T2:G17	0.0000	0.00000		
R2:T2:G18	0.0000	0.00000		
R2:T2:G19	0.0000	0.00000		
R2:T2:G20	0.0000	0.00000		
R2:T2:G21	-1.0000	0.64788	-1.5435	0.1314585
R2:T2:G22	0.3333	0.64788	0.5145	0.6100498
R2:T2:G23	0.0000	0.00000		
R3:T1:G1	0.0000	0.00000		
R3:T1:G2	0.0000	0.00000		
R3:T1:G3	0.0000	0.00000		
R3:T1:G4	0.0000	0.00000		
R3:T1:G5	0.0000	0.00000		
R3:T1:G6	0.0000	0.00000		
R3:T1:G7	0.0000	0.00000		
R3:T1:G8	0.0000	0.00000		
R3:T1:G9	0.0000	0.00000		
R3:T1:G10	0.0000	0.00000		
R3:T1:G11	0.0000	0.00000		
R3:T1:G12	0.0000	0.00000		
R3:T1:G13	0.0000	0.00000		
R3:T1:G14	0.0000	0.00000		
R3:T1:G15	0.0000	0.00000		
R3:T1:G16	0.0000	0.00000		
R3:T1:G17	0.0000	0.00000		
R3:T1:G18	0.0000	0.00000		
R3:T1:G19	0.0000	0.00000		
R3:T1:G20	0.0000	0.00000		
R3:T1:G21	-1.6667	0.64788	-2.5725	0.0143678 *
R3:T1:G22	0.6667	0.64788	1.0290	0.3103479
R3:T1:G23	0.0000	0.00000		
R3:T2:G1	0.0000	0.00000		
R3:T2:G2	0.0000	0.00000		
R3:T2:G3	0.0000	0.00000		
R3:T2:G4	0.0000	0.00000		
R3:T2:G5	0.0000	0.00000		
R3:T2:G6	0.0000	0.00000		
R3:T2:G7	0.0000	0.00000		
R3:T2:G8	0.0000	0.00000		
R3:T2:G9	0.0000	0.00000		
R3:T2:G10	0.0000	0.00000		

R3:T2:G11	0.0000	0.00000		
R3:T2:G12	0.0000	0.00000		
R3:T2:G13	0.0000	0.00000		
R3:T2:G14	0.0000	0.00000		
R3:T2:G15	0.0000	0.00000		
R3:T2:G16	0.0000	0.00000		
R3:T2:G17	0.0000	0.00000		
R3:T2:G18	0.0000	0.00000		
R3:T2:G19	0.0000	0.00000		
R3:T2:G20	0.0000	0.00000		
R3:T2:G21	-0.6667	0.64788	-1.0290	0.3103479
R3:T2:G22	0.0000	0.64788	0.0000	1.0000000
R3:T2:G23	0.0000	0.00000		
R4:T1:G1	0.0000	0.00000		
R4:T1:G2	0.0000	0.00000		
R4:T1:G3	0.0000	0.00000		
R4:T1:G4	0.0000	0.00000		
R4:T1:G5	0.0000	0.00000		
R4:T1:G6	0.0000	0.00000		
R4:T1:G7	0.0000	0.00000		
R4:T1:G8	0.0000	0.00000		
R4:T1:G9	0.0000	0.00000		
R4:T1:G10	0.0000	0.00000		
R4:T1:G11	0.0000	0.00000		
R4:T1:G12	0.0000	0.00000		
R4:T1:G13	0.0000	0.00000		
R4:T1:G14	0.0000	0.00000		
R4:T1:G15	0.0000	0.00000		
R4:T1:G16	0.0000	0.00000		
R4:T1:G17	0.0000	0.00000		
R4:T1:G18	0.0000	0.00000		
R4:T1:G19	0.0000	0.00000		
R4:T1:G20	0.0000	0.00000		
R4:T1:G21	0.0000	0.00000		
R4:T1:G22	0.0000	0.00000		
R4:T1:G23	0.0000	0.00000		
R4:T2:G1	0.0000	0.00000		
R4:T2:G2	0.0000	0.00000		
R4:T2:G3	0.0000	0.00000		
R4:T2:G4	0.0000	0.00000		
R4:T2:G5	0.0000	0.00000		
R4:T2:G6	0.0000	0.00000		
R4:T2:G7	0.0000	0.00000		
R4:T2:G8	0.0000	0.00000		
R4:T2:G9	0.0000	0.00000		
R4:T2:G10	0.0000	0.00000		
R4:T2:G11	0.0000	0.00000		
R4:T2:G12	0.0000	0.00000		

R4:T2:G13	0.0000	0.00000			
R4:T2:G14	0.0000	0.00000			
R4:T2:G15	0.0000	0.00000			
R4:T2:G16	0.0000	0.00000			
R4:T2:G17	0.0000	0.00000			
R4:T2:G18	0.0000	0.00000			
R4:T2:G19	0.0000	0.00000			
R4:T2:G20	0.0000	0.00000			
R4:T2:G21	0.0000	0.00000			
R4:T2:G22	0.0000	0.00000			
R4:T2:G23	0.0000	0.00000			
F1	-2.0000	0.39675	-5.0410	1.325e-05	***
F2	-1.0000	0.39675	-2.5205	0.0162919	*
F3	0.0000	0.00000			
T1:F1	-0.2500	0.56108	-0.4456	0.6585786	
T1:F2	0.0000	0.56108	0.0000	1.0000000	
T1:F3	0.0000	0.00000			
T2:F1	0.0000	0.00000			
T2:F2	0.0000	0.00000			
T2:F3	0.0000	0.00000			
G1:F1	0.0000	0.88715	0.0000	1.0000000	
G1:F2	0.0000	0.88715	0.0000	1.0000000	
G1:F3	0.0000	0.00000			
G2:F1	-2.0000	0.88715	-2.2544	0.0303508	*
G2:F2	-1.0000	0.88715	-1.1272	0.2671137	
G2:F3	0.0000	0.00000			
G3:F1	0.0000	0.88715	0.0000	1.0000000	
G3:F2	0.0000	0.88715	0.0000	1.0000000	
G3:F3	0.0000	0.00000			
G4:F1	2.0000	0.88715	2.2544	0.0303508	*
G4:F2	0.0000	0.88715	0.0000	1.0000000	
G4:F3	0.0000	0.00000			
G5:F1	0.0000	0.88715	0.0000	1.0000000	
G5:F2	1.0000	0.88715	1.1272	0.2671137	
G5:F3	0.0000	0.00000			
G6:F1	0.0000	0.88715	0.0000	1.0000000	
G6:F2	0.0000	0.88715	0.0000	1.0000000	
G6:F3	0.0000	0.00000			
G7:F1	1.0000	0.88715	1.1272	0.2671137	
G7:F2	1.0000	0.88715	1.1272	0.2671137	
G7:F3	0.0000	0.00000			
G8:F1	1.0000	0.88715	1.1272	0.2671137	
G8:F2	2.0000	0.88715	2.2544	0.0303508	*
G8:F3	0.0000	0.00000			
G9:F1	0.0000	0.88715	0.0000	1.0000000	
G9:F2	-1.0000	0.88715	-1.1272	0.2671137	
G9:F3	0.0000	0.00000			
G10:F1	-1.0000	0.88715	-1.1272	0.2671137	

G10:F2	-1.0000	0.88715	-1.1272	0.2671137
G10:F3	0.0000	0.00000		
G11:F1	1.0000	0.88715	1.1272	0.2671137
G11:F2	0.0000	0.88715	0.0000	1.0000000
G11:F3	0.0000	0.00000		
G12:F1	1.0000	0.88715	1.1272	0.2671137
G12:F2	0.0000	0.88715	0.0000	1.0000000
G12:F3	0.0000	0.00000		
G13:F1	0.0000	0.88715	0.0000	1.0000000
G13:F2	-1.0000	0.88715	-1.1272	0.2671137
G13:F3	0.0000	0.00000		
G14:F1	1.0000	0.88715	1.1272	0.2671137
G14:F2	1.0000	0.88715	1.1272	0.2671137
G14:F3	0.0000	0.00000		
G15:F1	-1.0000	0.88715	-1.1272	0.2671137
G15:F2	-1.0000	0.88715	-1.1272	0.2671137
G15:F3	0.0000	0.00000		
G16:F1	0.0000	0.88715	0.0000	1.0000000
G16:F2	-1.0000	0.88715	-1.1272	0.2671137
G16:F3	0.0000	0.00000		
G17:F1	-1.0000	0.88715	-1.1272	0.2671137
G17:F2	0.0000	0.88715	0.0000	1.0000000
G17:F3	0.0000	0.00000		
G18:F1	-1.0000	0.88715	-1.1272	0.2671137
G18:F2	0.0000	0.88715	0.0000	1.0000000
G18:F3	0.0000	0.00000		
G19:F1	0.0000	0.88715	0.0000	1.0000000
G19:F2	1.0000	0.88715	1.1272	0.2671137
G19:F3	0.0000	0.00000		
G20:F1	0.0000	0.88715	0.0000	1.0000000
G20:F2	0.0000	0.88715	0.0000	1.0000000
G20:F3	0.0000	0.00000		
G21:F1	-1.2500	0.56108	-2.2278	0.0322306 *
G21:F2	0.2500	0.56108	0.4456	0.6585786
G21:F3	0.0000	0.00000		
G22:F1	0.0000	0.56108	0.0000	1.0000000
G22:F2	0.0000	0.56108	0.0000	1.0000000
G22:F3	0.0000	0.00000		
G23:F1	0.0000	0.00000		
G23:F2	0.0000	0.00000		
G23:F3	0.0000	0.00000		
T1:G1:F1	-1.7500	1.25462	-1.3948	0.1716105
T1:G1:F2	-1.0000	1.25462	-0.7971	0.4306457
T1:G1:F3	0.0000	0.00000		
T1:G2:F1	0.2500	1.25462	0.1993	0.8431780
T1:G2:F2	0.0000	1.25462	0.0000	1.0000000
T1:G2:F3	0.0000	0.00000		
T1:G3:F1	0.2500	1.25462	0.1993	0.8431780



T1:G3:F2	-1.0000	1.25462	-0.7971	0.4306457
T1:G3:F3	0.0000	0.00000		
T1:G4:F1	-0.7500	1.25462	-0.5978	0.5537222
T1:G4:F2	0.0000	1.25462	0.0000	1.0000000
T1:G4:F3	0.0000	0.00000		
T1:G5:F1	1.2500	1.25462	0.9963	0.3257463
T1:G5:F2	-1.0000	1.25462	-0.7971	0.4306457
T1:G5:F3	0.0000	0.00000		
T1:G6:F1	0.2500	1.25462	0.1993	0.8431780
T1:G6:F2	0.0000	1.25462	0.0000	1.0000000
T1:G6:F3	0.0000	0.00000		
T1:G7:F1	-0.7500	1.25462	-0.5978	0.5537222
T1:G7:F2	-1.0000	1.25462	-0.7971	0.4306457
T1:G7:F3	0.0000	0.00000		
T1:G8:F1	-0.7500	1.25462	-0.5978	0.5537222
T1:G8:F2	-2.0000	1.25462	-1.5941	0.1196553
T1:G8:F3	0.0000	0.00000		
T1:G9:F1	0.2500	1.25462	0.1993	0.8431780
T1:G9:F2	1.0000	1.25462	0.7971	0.4306457
T1:G9:F3	0.0000	0.00000		
T1:G10:F1	0.2500	1.25462	0.1993	0.8431780
T1:G10:F2	1.0000	1.25462	0.7971	0.4306457
T1:G10:F3	0.0000	0.00000		
T1:G11:F1	-0.7500	1.25462	-0.5978	0.5537222
T1:G11:F2	0.0000	1.25462	0.0000	1.0000000
T1:G11:F3	0.0000	0.00000		
T1:G12:F1	0.2500	1.25462	0.1993	0.8431780
T1:G12:F2	1.0000	1.25462	0.7971	0.4306457
T1:G12:F3	0.0000	0.00000		
T1:G13:F1	1.2500	1.25462	0.9963	0.3257463
T1:G13:F2	2.0000	1.25462	1.5941	0.1196553
T1:G13:F3	0.0000	0.00000		
T1:G14:F1	-0.7500	1.25462	-0.5978	0.5537222
T1:G14:F2	-2.0000	1.25462	-1.5941	0.1196553
T1:G14:F3	0.0000	0.00000		
T1:G15:F1	1.2500	1.25462	0.9963	0.3257463
T1:G15:F2	1.0000	1.25462	0.7971	0.4306457
T1:G15:F3	0.0000	0.00000		
T1:G16:F1	-1.7500	1.25462	-1.3948	0.1716105
T1:G16:F2	0.0000	1.25462	0.0000	1.0000000
T1:G16:F3	0.0000	0.00000		
T1:G17:F1	0.2500	1.25462	0.1993	0.8431780
T1:G17:F2	0.0000	1.25462	0.0000	1.0000000
T1:G17:F3	0.0000	0.00000		
T1:G18:F1	0.2500	1.25462	0.1993	0.8431780
T1:G18:F2	-1.0000	1.25462	-0.7971	0.4306457
T1:G18:F3	0.0000	0.00000		
T1:G19:F1	-0.7500	1.25462	-0.5978	0.5537222

T1:G19:F2	-2.0000	1.25462	-1.5941	0.1196553
T1:G19:F3	0.0000	0.00000		
T1:G20:F1	0.2500	1.25462	0.1993	0.8431780
T1:G20:F2	-1.0000	1.25462	-0.7971	0.4306457
T1:G20:F3	0.0000	0.00000		
T1:G21:F1	0.2500	0.79349	0.3151	0.7545328
T1:G21:F2	-0.7500	0.79349	-0.9452	0.3508634
T1:G21:F3	0.0000	0.00000		
T1:G22:F1	0.0000	0.79349	0.0000	1.0000000
T1:G22:F2	0.0000	0.79349	0.0000	1.0000000
T1:G22:F3	0.0000	0.00000		
T1:G23:F1	0.0000	0.00000		
T1:G23:F2	0.0000	0.00000		
T1:G23:F3	0.0000	0.00000		
T2:G1:F1	0.0000	0.00000		
T2:G1:F2	0.0000	0.00000		
T2:G1:F3	0.0000	0.00000		
T2:G2:F1	0.0000	0.00000		
T2:G2:F2	0.0000	0.00000		
T2:G2:F3	0.0000	0.00000		
T2:G3:F1	0.0000	0.00000		
T2:G3:F2	0.0000	0.00000		
T2:G3:F3	0.0000	0.00000		
T2:G4:F1	0.0000	0.00000		
T2:G4:F2	0.0000	0.00000		
T2:G4:F3	0.0000	0.00000		
T2:G5:F1	0.0000	0.00000		
T2:G5:F2	0.0000	0.00000		
T2:G5:F3	0.0000	0.00000		
T2:G6:F1	0.0000	0.00000		
T2:G6:F2	0.0000	0.00000		
T2:G6:F3	0.0000	0.00000		
T2:G7:F1	0.0000	0.00000		
T2:G7:F2	0.0000	0.00000		
T2:G7:F3	0.0000	0.00000		
T2:G8:F1	0.0000	0.00000		
T2:G8:F2	0.0000	0.00000		
T2:G8:F3	0.0000	0.00000		
T2:G9:F1	0.0000	0.00000		
T2:G9:F2	0.0000	0.00000		
T2:G9:F3	0.0000	0.00000		
T2:G10:F1	0.0000	0.00000		
T2:G10:F2	0.0000	0.00000		
T2:G10:F3	0.0000	0.00000		
T2:G11:F1	0.0000	0.00000		
T2:G11:F2	0.0000	0.00000		
T2:G11:F3	0.0000	0.00000		
T2:G12:F1	0.0000	0.00000		

T2:G12:F2	0.0000	0.00000
T2:G12:F3	0.0000	0.00000
T2:G13:F1	0.0000	0.00000
T2:G13:F2	0.0000	0.00000
T2:G13:F3	0.0000	0.00000
T2:G14:F1	0.0000	0.00000
T2:G14:F2	0.0000	0.00000
T2:G14:F3	0.0000	0.00000
T2:G15:F1	0.0000	0.00000
T2:G15:F2	0.0000	0.00000
T2:G15:F3	0.0000	0.00000
T2:G16:F1	0.0000	0.00000
T2:G16:F2	0.0000	0.00000
T2:G16:F3	0.0000	0.00000
T2:G17:F1	0.0000	0.00000
T2:G17:F2	0.0000	0.00000
T2:G17:F3	0.0000	0.00000
T2:G18:F1	0.0000	0.00000
T2:G18:F2	0.0000	0.00000
T2:G18:F3	0.0000	0.00000
T2:G19:F1	0.0000	0.00000
T2:G19:F2	0.0000	0.00000
T2:G19:F3	0.0000	0.00000
T2:G20:F1	0.0000	0.00000
T2:G20:F2	0.0000	0.00000
T2:G20:F3	0.0000	0.00000
T2:G21:F1	0.0000	0.00000
T2:G21:F2	0.0000	0.00000
T2:G21:F3	0.0000	0.00000
T2:G22:F1	0.0000	0.00000
T2:G22:F2	0.0000	0.00000
T2:G22:F3	0.0000	0.00000
T2:G23:F1	0.0000	0.00000
T2:G23:F2	0.0000	0.00000
T2:G23:F3	0.0000	0.00000

---

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

(88) MODEL

```
ex8.1 = read.table("C:/G/Rt/Split/asbed.txt", header=TRUE)
ex8.1 = af(ex8.1, c("R", "A", "B"))
GLM(Y ~ R + A + R:A + B + B:R + A:B + A:B:R, ex8.1)
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	104	3951.8	37.999		
RESIDUALS	0	0.0			
CORRECTED TOTAL	104	3951.8			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	1787.68	893.84		
A	12	601.24	50.10		
R:A	6	24.93	4.16		
B	8	156.87	19.61		
R:B	4	319.87	79.97		
A:B	60	1012.26	16.87		
R:A:B	12	49.00	4.08		

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	372.22	186.111		
A	12	601.24	50.103		
R:A	6	50.00	8.333		

B	8	156.87	19.609
R:B	4	87.44	21.861
A:B	60	1012.26	16.871
R:A:B	12	49.00	4.083

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	372.22	186.111		
A	12	572.31	47.692		
R:A	6	50.00	8.333		
B	8	185.85	23.231		
R:B	4	87.44	21.861		
A:B	60	1012.26	16.871		
R:A:B	12	49.00	4.083		

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	14			
R1	-10			
R2	-10			
R3	0			
A1	1			
A2	0			
A3	1			
A4	4			
A5	4			
A6	8			
A7	0			
A8	31			
A9	20			
A10	-4			
A11	0			
A12	1			
A13	0			
R1:A1	0			
R1:A2	0			
R1:A3	0			
R1:A4	0			
R1:A5	0			
R1:A6	0			
R1:A7	0			
R1:A8	0			
R1:A9	0			
R1:A10	5			
R1:A11	0			
R1:A12	0			
R1:A13	0			
R2:A1	0			

R2:A2	0
R2:A3	0
R2:A4	0
R2:A5	0
R2:A6	0
R2:A7	0
R2:A8	0
R2:A9	0
R2:A10	5
R2:A11	0
R2:A12	0
R2:A13	0
R3:A1	0
R3:A2	0
R3:A3	0
R3:A4	0
R3:A5	0
R3:A6	0
R3:A7	0
R3:A8	0
R3:A9	0
R3:A10	0
R3:A11	0
R3:A12	0
R3:A13	0
B1	5
B2	3
B3	5
B4	3
B5	-5
B6	3
B7	-1
B8	1
B9	0
R1:B1	0
R1:B2	0
R1:B3	0
R1:B4	0
R1:B5	0
R1:B6	0
R1:B7	0
R1:B8	0
R1:B9	0
R2:B1	0
R2:B2	0
R2:B3	0
R2:B4	0
R2:B5	0

R2:B6	0
R2:B7	10
R2:B8	0
R2:B9	0
R3:B1	0
R3:B2	0
R3:B3	0
R3:B4	0
R3:B5	0
R3:B6	0
R3:B7	0
R3:B8	0
R3:B9	0
A1:B1	-1
A1:B2	-6
A1:B3	0
A1:B4	0
A1:B5	0
A1:B6	0
A1:B7	4
A1:B8	1
A1:B9	0
A2:B1	0
A2:B2	0
A2:B3	0
A2:B4	0
A2:B5	0
A2:B6	0
A2:B7	0
A2:B8	0
A2:B9	0
A3:B1	-1
A3:B2	-6
A3:B3	0
A3:B4	0
A3:B5	0
A3:B6	0
A3:B7	4
A3:B8	1
A3:B9	0
A4:B1	0
A4:B2	0
A4:B3	-4
A4:B4	-4
A4:B5	0
A4:B6	0
A4:B7	-4
A4:B8	-1

A4:B9	0
A5:B1	0
A5:B2	0
A5:B3	-4
A5:B4	1
A5:B5	0
A5:B6	0
A5:B7	-9
A5:B8	-2
A5:B9	0
A6:B1	0
A6:B2	0
A6:B3	-8
A6:B4	-8
A6:B5	0
A6:B6	0
A6:B7	-8
A6:B8	-4
A6:B9	0
A7:B1	0
A7:B2	0
A7:B3	0
A7:B4	0
A7:B5	10
A7:B6	0
A7:B7	0
A7:B8	0
A7:B9	0
A8:B1	0
A8:B2	0
A8:B3	0
A8:B4	0
A8:B5	-21
A8:B6	-36
A8:B7	-26
A8:B8	-29
A8:B9	0
A9:B1	0
A9:B2	0
A9:B3	0
A9:B4	0
A9:B5	-10
A9:B6	-20
A9:B7	-20
A9:B8	-10
A9:B9	0
A10:B1	-1
A10:B2	-7



A10:B3	-1
A10:B4	3
A10:B5	10
A10:B6	-4
A10:B7	2
A10:B8	-1
A10:B9	0
A11:B1	0
A11:B2	0
A11:B3	0
A11:B4	0
A11:B5	0
A11:B6	0
A11:B7	0
A11:B8	0
A11:B9	0
A12:B1	-1
A12:B2	-6
A12:B3	-1
A12:B4	4
A12:B5	-1
A12:B6	-6
A12:B7	-6
A12:B8	1
A12:B9	0
A13:B1	0
A13:B2	0
A13:B3	0
A13:B4	0
A13:B5	0
A13:B6	0
A13:B7	0
A13:B8	0
A13:B9	0
R1:A1:B1	0
R1:A1:B2	0
R1:A1:B3	0
R1:A1:B4	0
R1:A1:B5	0
R1:A1:B6	0
R1:A1:B7	0
R1:A1:B8	0
R1:A1:B9	0
R1:A2:B1	0
R1:A2:B2	0
R1:A2:B3	0
R1:A2:B4	0
R1:A2:B5	0

R1:A2:B6	0
R1:A2:B7	0
R1:A2:B8	0
R1:A2:B9	0
R1:A3:B1	0
R1:A3:B2	0
R1:A3:B3	0
R1:A3:B4	0
R1:A3:B5	0
R1:A3:B6	0
R1:A3:B7	0
R1:A3:B8	0
R1:A3:B9	0
R1:A4:B1	0
R1:A4:B2	0
R1:A4:B3	0
R1:A4:B4	0
R1:A4:B5	0
R1:A4:B6	0
R1:A4:B7	0
R1:A4:B8	0
R1:A4:B9	0
R1:A5:B1	0
R1:A5:B2	0
R1:A5:B3	0
R1:A5:B4	0
R1:A5:B5	0
R1:A5:B6	0
R1:A5:B7	0
R1:A5:B8	0
R1:A5:B9	0
R1:A6:B1	0
R1:A6:B2	0
R1:A6:B3	0
R1:A6:B4	0
R1:A6:B5	0
R1:A6:B6	0
R1:A6:B7	0
R1:A6:B8	0
R1:A6:B9	0
R1:A7:B1	0
R1:A7:B2	0
R1:A7:B3	0
R1:A7:B4	0
R1:A7:B5	0
R1:A7:B6	0
R1:A7:B7	0
R1:A7:B8	0

R1:A7:B9	0
R1:A8:B1	0
R1:A8:B2	0
R1:A8:B3	0
R1:A8:B4	0
R1:A8:B5	0
R1:A8:B6	0
R1:A8:B7	0
R1:A8:B8	0
R1:A8:B9	0
R1:A9:B1	0
R1:A9:B2	0
R1:A9:B3	0
R1:A9:B4	0
R1:A9:B5	0
R1:A9:B6	0
R1:A9:B7	0
R1:A9:B8	0
R1:A9:B9	0
R1:A10:B1	0
R1:A10:B2	0
R1:A10:B3	0
R1:A10:B4	0
R1:A10:B5	0
R1:A10:B6	0
R1:A10:B7	3
R1:A10:B8	2
R1:A10:B9	0
R1:A11:B1	0
R1:A11:B2	0
R1:A11:B3	0
R1:A11:B4	0
R1:A11:B5	0
R1:A11:B6	0
R1:A11:B7	0
R1:A11:B8	0
R1:A11:B9	0
R1:A12:B1	0
R1:A12:B2	0
R1:A12:B3	0
R1:A12:B4	0
R1:A12:B5	0
R1:A12:B6	0
R1:A12:B7	10
R1:A12:B8	0
R1:A12:B9	0
R1:A13:B1	0
R1:A13:B2	0

R1:A13:B3	0
R1:A13:B4	0
R1:A13:B5	0
R1:A13:B6	0
R1:A13:B7	0
R1:A13:B8	0
R1:A13:B9	0
R2:A1:B1	0
R2:A1:B2	0
R2:A1:B3	0
R2:A1:B4	0
R2:A1:B5	0
R2:A1:B6	0
R2:A1:B7	0
R2:A1:B8	0
R2:A1:B9	0
R2:A2:B1	0
R2:A2:B2	0
R2:A2:B3	0
R2:A2:B4	0
R2:A2:B5	0
R2:A2:B6	0
R2:A2:B7	0
R2:A2:B8	0
R2:A2:B9	0
R2:A3:B1	0
R2:A3:B2	0
R2:A3:B3	0
R2:A3:B4	0
R2:A3:B5	0
R2:A3:B6	0
R2:A3:B7	0
R2:A3:B8	0
R2:A3:B9	0
R2:A4:B1	0
R2:A4:B2	0
R2:A4:B3	0
R2:A4:B4	0
R2:A4:B5	0
R2:A4:B6	0
R2:A4:B7	0
R2:A4:B8	0
R2:A4:B9	0
R2:A5:B1	0
R2:A5:B2	0
R2:A5:B3	0
R2:A5:B4	0
R2:A5:B5	0

R2:A5:B6	0
R2:A5:B7	0
R2:A5:B8	0
R2:A5:B9	0
R2:A6:B1	0
R2:A6:B2	0
R2:A6:B3	0
R2:A6:B4	0
R2:A6:B5	0
R2:A6:B6	0
R2:A6:B7	0
R2:A6:B8	0
R2:A6:B9	0
R2:A7:B1	0
R2:A7:B2	0
R2:A7:B3	0
R2:A7:B4	0
R2:A7:B5	0
R2:A7:B6	0
R2:A7:B7	0
R2:A7:B8	0
R2:A7:B9	0
R2:A8:B1	0
R2:A8:B2	0
R2:A8:B3	0
R2:A8:B4	0
R2:A8:B5	0
R2:A8:B6	0
R2:A8:B7	0
R2:A8:B8	0
R2:A8:B9	0
R2:A9:B1	0
R2:A9:B2	0
R2:A9:B3	0
R2:A9:B4	0
R2:A9:B5	0
R2:A9:B6	0
R2:A9:B7	0
R2:A9:B8	0
R2:A9:B9	0
R2:A10:B1	0
R2:A10:B2	0
R2:A10:B3	0
R2:A10:B4	0
R2:A10:B5	0
R2:A10:B6	0
R2:A10:B7	-7
R2:A10:B8	2

R2:A10:B9	0
R2:A11:B1	0
R2:A11:B2	0
R2:A11:B3	0
R2:A11:B4	0
R2:A11:B5	0
R2:A11:B6	0
R2:A11:B7	0
R2:A11:B8	0
R2:A11:B9	0
R2:A12:B1	0
R2:A12:B2	0
R2:A12:B3	0
R2:A12:B4	0
R2:A12:B5	0
R2:A12:B6	0
R2:A12:B7	0
R2:A12:B8	0
R2:A12:B9	0
R2:A13:B1	0
R2:A13:B2	0
R2:A13:B3	0
R2:A13:B4	0
R2:A13:B5	0
R2:A13:B6	0
R2:A13:B7	0
R2:A13:B8	0
R2:A13:B9	0
R3:A1:B1	0
R3:A1:B2	0
R3:A1:B3	0
R3:A1:B4	0
R3:A1:B5	0
R3:A1:B6	0
R3:A1:B7	0
R3:A1:B8	0
R3:A1:B9	0
R3:A2:B1	0
R3:A2:B2	0
R3:A2:B3	0
R3:A2:B4	0
R3:A2:B5	0
R3:A2:B6	0
R3:A2:B7	0
R3:A2:B8	0
R3:A2:B9	0
R3:A3:B1	0
R3:A3:B2	0

R3:A3:B3	0
R3:A3:B4	0
R3:A3:B5	0
R3:A3:B6	0
R3:A3:B7	0
R3:A3:B8	0
R3:A3:B9	0
R3:A4:B1	0
R3:A4:B2	0
R3:A4:B3	0
R3:A4:B4	0
R3:A4:B5	0
R3:A4:B6	0
R3:A4:B7	0
R3:A4:B8	0
R3:A4:B9	0
R3:A5:B1	0
R3:A5:B2	0
R3:A5:B3	0
R3:A5:B4	0
R3:A5:B5	0
R3:A5:B6	0
R3:A5:B7	0
R3:A5:B8	0
R3:A5:B9	0
R3:A6:B1	0
R3:A6:B2	0
R3:A6:B3	0
R3:A6:B4	0
R3:A6:B5	0
R3:A6:B6	0
R3:A6:B7	0
R3:A6:B8	0
R3:A6:B9	0
R3:A7:B1	0
R3:A7:B2	0
R3:A7:B3	0
R3:A7:B4	0
R3:A7:B5	0
R3:A7:B6	0
R3:A7:B7	0
R3:A7:B8	0
R3:A7:B9	0
R3:A8:B1	0
R3:A8:B2	0
R3:A8:B3	0
R3:A8:B4	0
R3:A8:B5	0

R3:A8:B6	0
R3:A8:B7	0
R3:A8:B8	0
R3:A8:B9	0
R3:A9:B1	0
R3:A9:B2	0
R3:A9:B3	0
R3:A9:B4	0
R3:A9:B5	0
R3:A9:B6	0
R3:A9:B7	0
R3:A9:B8	0
R3:A9:B9	0
R3:A10:B1	0
R3:A10:B2	0
R3:A10:B3	0
R3:A10:B4	0
R3:A10:B5	0
R3:A10:B6	0
R3:A10:B7	0
R3:A10:B8	0
R3:A10:B9	0
R3:A11:B1	0
R3:A11:B2	0
R3:A11:B3	0
R3:A11:B4	0
R3:A11:B5	0
R3:A11:B6	0
R3:A11:B7	0
R3:A11:B8	0
R3:A11:B9	0
R3:A12:B1	0
R3:A12:B2	0
R3:A12:B3	0
R3:A12:B4	0
R3:A12:B5	0
R3:A12:B6	0
R3:A12:B7	0
R3:A12:B8	0
R3:A12:B9	0
R3:A13:B1	0
R3:A13:B2	0
R3:A13:B3	0
R3:A13:B4	0
R3:A13:B5	0
R3:A13:B6	0
R3:A13:B7	0
R3:A13:B8	0



R3:A13:B9

0

```
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(Y ~ R + A + R:A + B + B:R + A:B + A:B:R, ex8.1), type="III",
      singular.ok=TRUE) # NOT WORKING
```

## 7.12 Example 9.1

(89) MODEL

```
ex9.1 = read.table("C:/G/Rt/Split/Ex9.1-spex1.txt", header=TRUE)
ex9.1 = af(ex9.1, c("R", "A", "B"))
GLM(Y ~ R + A + R:A + B + A:B, ex9.1)
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	27	4920.8	182.251	10.594	5.927e-10 ***
RESIDUALS	34	584.9	17.203		
CORRECTED TOTAL	61	5505.6			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	218.7	72.89	4.2369	0.01199 *
A	3	194.9	64.96	3.7760	0.01930 *
R:A	9	186.9	20.76	1.2070	0.32287
B	3	4087.4	1362.47	79.2018	1.998e-15 ***
A:B	9	233.0	25.88	1.5047	0.18602

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	157.8	52.61	3.0583	0.04134 *
A	3	227.2	75.73	4.4020	0.01014 *
R:A	9	94.5	10.50	0.6106	0.77932
B	3	4087.4	1362.47	79.2018	1.998e-15 ***
A:B	9	233.0	25.88	1.5047	0.18602

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	171.0	57.01	3.3138	0.03143 *

```

A      3  209.7   69.92  4.0643   0.01431 *
R:A    9   94.5   10.50  0.6106   0.77932
B      3 4089.9 1363.29 79.2493 1.998e-15 ***
A:B    9  233.0   25.88  1.5047   0.18602

```

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	70.167	4.1476	16.9175	< 2.2e-16 ***
R1	4.417	3.7862	1.1665	0.25152
R2	7.692	3.7862	2.0315	0.05008 .
R3	3.492	3.7862	0.9222	0.36292
R4	0.000	0.0000		
A1	3.390	4.9728	0.6816	0.50009
A2	-7.679	4.9728	-1.5442	0.13179
A3	-1.235	4.9728	-0.2484	0.80529
A4	0.000	0.0000		
R1:A1	-1.717	4.7892	-0.3584	0.72223
R1:A2	-1.042	4.7892	-0.2175	0.82912
R1:A3	-1.467	4.7892	-0.3062	0.76129
R1:A4	0.000	0.0000		
R2:A1	-8.992	4.7892	-1.8775	0.06905 .
R2:A2	-2.817	4.7892	-0.5881	0.56033
R2:A3	-4.142	4.7892	-0.8648	0.39322
R2:A4	0.000	0.0000		
R3:A1	-5.217	4.7892	-1.0893	0.28370
R3:A2	-3.292	4.7892	-0.6873	0.49655
R3:A3	-4.317	4.7892	-0.9013	0.37375
R3:A4	0.000	0.0000		
R4:A1	0.000	0.0000		
R4:A2	0.000	0.0000		
R4:A3	0.000	0.0000		
R4:A4	0.000	0.0000		
B1	-3.517	3.2790	-1.0725	0.29105
B2	-18.817	3.2790	-5.7386	1.882e-06 ***
B3	-2.100	3.3865	-0.6201	0.53932
B4	0.000	0.0000		
A1:B1	5.417	4.3992	1.2313	0.22666
A1:B2	-2.558	4.3992	-0.5815	0.56471
A1:B3	0.850	4.4799	0.1897	0.85064
A1:B4	0.000	0.0000		
A2:B1	11.217	4.3992	2.5497	0.01546 *
A2:B2	5.567	4.3992	1.2654	0.21434
A2:B3	5.500	4.4799	1.2277	0.22799
A2:B4	0.000	0.0000		
A3:B1	0.492	4.3992	0.1118	0.91167
A3:B2	-1.083	4.3992	-0.2463	0.80696

A3:B3	3.000	4.4799	0.6697	0.50760
A3:B4	0.000	0.0000		
A4:B1	0.000	0.0000		
A4:B2	0.000	0.0000		
A4:B3	0.000	0.0000		
A4:B4	0.000	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

### 7.13 Example 9.2

(90) MODEL

```
ex9.2 = read.table("C:/G/Rt/Split/Ex9.2-sbex.txt", header=TRUE)
ex9.2 = af(ex9.2, c("rep", "hyb", "gen"))
GLM(yield ~ rep + hyb + rep:hyb + gen + gen:rep + gen:hyb, ex9.2)
```

\$ANOVA

Response : yield

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	40	247.813	6.1953	4.4606	0.001119 **
RESIDUALS	16	22.222	1.3889		
CORRECTED TOTAL	56	270.035			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	0.239	0.2388	0.1719	0.6839085
hyb	9	66.796	7.4218	5.3437	0.0018370 **
rep:hyb	8	67.000	8.3750	6.0300	0.0011569 **
gen	2	36.351	18.1754	13.0863	0.0004293 ***
rep:gen	2	16.923	8.4616	6.0924	0.0107858 *
hyb:gen	18	60.504	3.3613	2.4201	0.0408545 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	0.167	0.1667	0.1200	0.7335481
hyb	9	66.796	7.4218	5.3437	0.0018370 **
rep:hyb	8	67.000	8.3750	6.0300	0.0011569 **
gen	2	36.351	18.1754	13.0863	0.0004293 ***
rep:gen	2	12.111	6.0556	4.3600	0.0308015 *
hyb:gen	18	60.504	3.3613	2.4201	0.0408545 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	0.167	0.1667	0.1200	0.7335481
hyb	9	66.796	7.4218	5.3437	0.0018370 **
rep:hyb	8	67.000	8.3750	6.0300	0.0011569 **
gen	2	30.671	15.3356	11.0416	0.0009707 ***
rep:gen	2	12.111	6.0556	4.3600	0.0308015 *
hyb:gen	18	60.504	3.3613	2.4201	0.0408545 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	46.556	0.98862	47.0915	< 2.2e-16 ***
rep1	0.889	1.06381	0.8356	0.415699
rep2	0.000	0.00000		
hyb0	-2.444	1.53826	-1.5891	0.131602
hyb1	2.667	1.36083	1.9596	0.067702 .
hyb2	1.000	1.36083	0.7348	0.473067
hyb3	-2.167	1.36083	-1.5922	0.130908
hyb4	1.000	1.36083	0.7348	0.473067
hyb5	-1.333	1.36083	-0.9798	0.341771
hyb6	1.500	1.36083	1.1023	0.286649
hyb7	4.500	1.36083	3.3068	0.004455 **
hyb8	-0.167	1.36083	-0.1225	0.904048
hyb9	0.000	0.00000		
rep1:hyb0	0.000	0.00000		
rep1:hyb1	-3.333	1.36083	-2.4495	0.026199 *
rep1:hyb2	-4.000	1.36083	-2.9394	0.009621 **
rep1:hyb3	0.333	1.36083	0.2449	0.809610
rep1:hyb4	0.000	1.36083	0.0000	1.000000
rep1:hyb5	2.667	1.36083	1.9596	0.067702 .
rep1:hyb6	-4.000	1.36083	-2.9394	0.009621 **
rep1:hyb7	-3.000	1.36083	-2.2045	0.042471 *
rep1:hyb8	-2.667	1.36083	-1.9596	0.067702 .
rep1:hyb9	0.000	0.00000		
rep2:hyb0	0.000	0.00000		
rep2:hyb1	0.000	0.00000		
rep2:hyb2	0.000	0.00000		
rep2:hyb3	0.000	0.00000		
rep2:hyb4	0.000	0.00000		
rep2:hyb5	0.000	0.00000		
rep2:hyb6	0.000	0.00000		
rep2:hyb7	0.000	0.00000		
rep2:hyb8	0.000	0.00000		
rep2:hyb9	0.000	0.00000		

gen1	-3.056	1.24226	-2.4597	0.025671 *
gen2	-0.611	1.24226	-0.4919	0.629446
gen3	0.000	0.00000		
rep1:gen1	2.111	0.78567	2.6870	0.016197 *
rep1:gen2	0.222	0.78567	0.2828	0.780924
rep1:gen3	0.000	0.00000		
rep2:gen1	0.000	0.00000		
rep2:gen2	0.000	0.00000		
rep2:gen3	0.000	0.00000		
hyb0:gen1	3.944	2.07870	1.8976	0.075951 .
hyb0:gen2	0.389	2.07870	0.1871	0.853947
hyb0:gen3	0.000	0.00000		
hyb1:gen1	-3.000	1.66667	-1.8000	0.090743 .
hyb1:gen2	-4.000	1.66667	-2.4000	0.028919 *
hyb1:gen3	0.000	0.00000		
hyb2:gen1	2.500	1.66667	1.5000	0.153088
hyb2:gen2	-2.500	1.66667	-1.5000	0.153088
hyb2:gen3	0.000	0.00000		
hyb3:gen1	2.000	1.66667	1.2000	0.247607
hyb3:gen2	-0.500	1.66667	-0.3000	0.768040
hyb3:gen3	0.000	0.00000		
hyb4:gen1	-2.000	1.66667	-1.2000	0.247607
hyb4:gen2	-1.000	1.66667	-0.6000	0.556909
hyb4:gen3	0.000	0.00000		
hyb5:gen1	1.000	1.66667	0.6000	0.556909
hyb5:gen2	0.000	1.66667	0.0000	1.000000
hyb5:gen3	0.000	0.00000		
hyb6:gen1	-1.000	1.66667	-0.6000	0.556909
hyb6:gen2	-0.500	1.66667	-0.3000	0.768040
hyb6:gen3	0.000	0.00000		
hyb7:gen1	-0.500	1.66667	-0.3000	0.768040
hyb7:gen2	-2.000	1.66667	-1.2000	0.247607
hyb7:gen3	0.000	0.00000		
hyb8:gen1	2.500	1.66667	1.5000	0.153088
hyb8:gen2	-2.000	1.66667	-1.2000	0.247607
hyb8:gen3	0.000	0.00000		
hyb9:gen1	0.000	0.00000		
hyb9:gen2	0.000	0.00000		
hyb9:gen3	0.000	0.00000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

```
options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(yield ~ rep + hyb + rep:hyb + gen + gen:rep + gen:hyb, ex9.2), type=3,
       singular.ok=TRUE) # NOT OK
```

Note: model has aliased coefficients

sums of squares computed by model comparison

Anova Table (Type III tests)

Response: yield

	Sum Sq	Df	F	values	Pr(>F)
rep	0.000	0			
hyb	66.704	8	6.0033	0.0011847	**
gen	30.671	2	11.0416	0.0009707	***
rep:hyb	67.000	8	6.0300	0.0011569	**
rep:gen	12.111	2	4.3600	0.0308015	*
hyb:gen	60.504	18	2.4201	0.0408545	*
Residuals	22.222	16			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 7.14 Example 10.1

(91) MODEL

```
ex10.1 = read.table("C:/G/Rt/Split/Ex10.1-new.txt", header=TRUE)
ex10.1 = af(ex10.1, c("Site", "Block", "A", "B", "C"))
f10.1 = Yield ~ Site/Block + A/Site + B/Site + A:B + A:B:Site + A:B:Site:Block +
        C + A:C + B:C + A:B:C + C:Site + A:C:Site + B:C:Site + A:B:C:Site
GLM(f10.1, ex10.1)
```

\$ANOVA

Response : Yield

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	239	1639561484	6860090	2162	< 2.2e-16 ***
RESIDUALS	240	761522	3173		
CORRECTED TOTAL	479	1640323006			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Site	3	552717	184239	5.8064e+01	< 2e-16 ***
Site:Block	8	7062320	882790	2.7822e+02	< 2e-16 ***
A	4	1387680917	346920229	1.0933e+05	< 2e-16 ***
Site:A	12	34068	2839	8.9470e-01	0.55301
B	1	100939695	100939695	3.1812e+04	< 2e-16 ***
Site:B	3	1618	539	1.6990e-01	0.91662
A:B	4	31444008	7861002	2.4775e+03	< 2e-16 ***
Site:A:B	12	33737	2811	8.8600e-01	0.56185
Site:Block:A:B	72	186911	2596	8.1810e-01	0.84155

C	3	19356264	6452088	2.0334e+03	< 2e-16	***
A:C	12	26075792	2172983	6.8483e+02	< 2e-16	***
B:C	3	23901388	7967129	2.5109e+03	< 2e-16	***
A:B:C	12	41996729	3499727	1.1030e+03	< 2e-16	***
Site:C	9	47625	5292	1.6677e+00	0.09747	.
Site:A:C	36	104110	2892	9.1140e-01	0.61768	
Site:B:C	9	61111	6790	2.1400e+00	0.02701	*
Site:A:B:C	36	82475	2291	7.2200e-01	0.87941	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Site	3	552717	184239	5.8064e+01	< 2e-16 ***
Site:Block	8	7062320	882790	2.7822e+02	< 2e-16 ***
A	4	1387680917	346920229	1.0933e+05	< 2e-16 ***
Site:A	12	34068	2839	8.9470e-01	0.55301
B	1	100939695	100939695	3.1812e+04	< 2e-16 ***
Site:B	3	1618	539	1.6990e-01	0.91662
A:B	4	31444008	7861002	2.4775e+03	< 2e-16 ***
Site:A:B	12	33737	2811	8.8600e-01	0.56185
Site:Block:A:B	72	186911	2596	8.1810e-01	0.84155
C	3	19356264	6452088	2.0334e+03	< 2e-16 ***
A:C	12	26075792	2172983	6.8483e+02	< 2e-16 ***
B:C	3	23901388	7967129	2.5109e+03	< 2e-16 ***
A:B:C	12	41996729	3499727	1.1030e+03	< 2e-16 ***
Site:C	9	47625	5292	1.6677e+00	0.09747 .
Site:A:C	36	104110	2892	9.1140e-01	0.61768
Site:B:C	9	61111	6790	2.1400e+00	0.02701 *
Site:A:B:C	36	82475	2291	7.2200e-01	0.87941

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Site	3	552717	184239	5.8064e+01	< 2e-16 ***
Site:Block	8	7062320	882790	2.7822e+02	< 2e-16 ***
A	4	1387680917	346920229	1.0933e+05	< 2e-16 ***
Site:A	12	34068	2839	8.9470e-01	0.55301
B	1	100939695	100939695	3.1812e+04	< 2e-16 ***
Site:B	3	1618	539	1.6990e-01	0.91662
A:B	4	31444008	7861002	2.4775e+03	< 2e-16 ***
Site:A:B	12	33737	2811	8.8600e-01	0.56185
Site:Block:A:B	72	186911	2596	8.1810e-01	0.84155
C	3	19356264	6452088	2.0334e+03	< 2e-16 ***
A:C	12	26075792	2172983	6.8483e+02	< 2e-16 ***
B:C	3	23901388	7967129	2.5109e+03	< 2e-16 ***
A:B:C	12	41996729	3499727	1.1030e+03	< 2e-16 ***

Site:C	9	47625	5292	1.6677e+00	0.09747	.
Site:A:C	36	104110	2892	9.1140e-01	0.61768	
Site:B:C	9	61111	6790	2.1400e+00	0.02701	*
Site:A:B:C	36	82475	2291	7.2200e-01	0.87941	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	13608.3	39.831	341.6522	< 2.2e-16	***
Site1	-433.3	56.329	-7.6928	3.713e-13	***
Site2	-108.3	56.329	-1.9232	0.055637	.
Site3	-116.7	56.329	-2.0711	0.039414	*
Site4	0.0	0.000			
Site1:BlockR1	175.0	39.831	4.3936	1.674e-05	***
Site1:BlockR2	300.0	39.831	7.5318	1.013e-12	***
Site1:BlockR3	0.0	0.000			
Site2:BlockR1	-225.0	39.831	-5.6489	4.554e-08	***
Site2:BlockR2	-375.0	39.831	-9.4148	< 2.2e-16	***
Site2:BlockR3	0.0	0.000			
Site3:BlockR1	-100.0	39.831	-2.5106	0.012711	*
Site3:BlockR2	-75.0	39.831	-1.8830	0.060916	.
Site3:BlockR3	0.0	0.000			
Site4:BlockR1	-250.0	39.831	-6.2765	1.605e-09	***
Site4:BlockR2	-275.0	39.831	-6.9042	4.483e-11	***
Site4:BlockR3	0.0	0.000			
AA1	-5705.0	56.329	-101.2791	< 2.2e-16	***
AA2	-5020.2	56.329	-89.1230	< 2.2e-16	***
AA3	-3336.7	56.329	-59.2363	< 2.2e-16	***
AA4	-1241.7	56.329	-22.0429	< 2.2e-16	***
AA5	0.0	0.000			
Site1:AA1	-2.4	79.662	-0.0303	0.975824	
Site1:AA2	25.0	79.662	0.3138	0.753926	
Site1:AA3	111.2	79.662	1.3965	0.163846	
Site1:AA4	-16.7	79.662	-0.2092	0.834456	
Site1:AA5	0.0	0.000			
Site2:AA1	91.2	79.662	1.1444	0.253590	
Site2:AA2	132.4	79.662	1.6622	0.097771	.
Site2:AA3	30.7	79.662	0.3850	0.700608	
Site2:AA4	-50.0	79.662	-0.6277	0.530828	
Site2:AA5	0.0	0.000			
Site3:AA1	39.2	79.662	0.4917	0.623408	
Site3:AA2	25.8	79.662	0.3243	0.746003	
Site3:AA3	-38.3	79.662	-0.4802	0.631555	
Site3:AA4	-41.7	79.662	-0.5230	0.601426	
Site3:AA5	0.0	0.000			
Site4:AA1	0.0	0.000			
Site4:AA2	0.0	0.000			



Site4:AA3	0.0	0.000		
Site4:AA4	0.0	0.000		
Site4:AA5	0.0	0.000		
BB1	-1300.0	56.329	-23.0785	< 2.2e-16 ***
BB2	0.0	0.000		
Site1:BB1	-16.7	79.662	-0.2092	0.834456
Site1:BB2	0.0	0.000		
Site2:BB1	100.0	79.662	1.2553	0.210589
Site2:BB2	0.0	0.000		
Site3:BB1	0.0	79.662	0.0000	1.000000
Site3:BB2	0.0	0.000		
Site4:BB1	0.0	0.000		
Site4:BB2	0.0	0.000		
AA1:BB1	1438.0	79.662	18.0513	< 2.2e-16 ***
AA1:BB2	0.0	0.000		
AA2:BB1	1746.3	79.662	21.9218	< 2.2e-16 ***
AA2:BB2	0.0	0.000		
AA3:BB1	2470.3	79.662	31.0102	< 2.2e-16 ***
AA3:BB2	0.0	0.000		
AA4:BB1	-68.1	79.662	-0.8547	0.393595
AA4:BB2	0.0	0.000		
AA5:BB1	0.0	0.000		
AA5:BB2	0.0	0.000		
Site1:AA1:BB1	54.5	112.659	0.4838	0.628997
Site1:AA1:BB2	0.0	0.000		
Site1:AA2:BB1	-20.4	112.659	-0.1812	0.856344
Site1:AA2:BB2	0.0	0.000		
Site1:AA3:BB1	-141.2	112.659	-1.2530	0.211409
Site1:AA3:BB2	0.0	0.000		
Site1:AA4:BB1	45.6	112.659	0.4046	0.686122
Site1:AA4:BB2	0.0	0.000		
Site1:AA5:BB1	0.0	0.000		
Site1:AA5:BB2	0.0	0.000		
Site2:AA1:BB1	-90.0	112.659	-0.7989	0.425155
Site2:AA1:BB2	0.0	0.000		
Site2:AA2:BB1	-140.2	112.659	-1.2442	0.214651
Site2:AA2:BB2	0.0	0.000		
Site2:AA3:BB1	-60.0	112.659	-0.5326	0.594816
Site2:AA3:BB2	0.0	0.000		
Site2:AA4:BB1	3.5	112.659	0.0311	0.975242
Site2:AA4:BB2	0.0	0.000		
Site2:AA5:BB1	0.0	0.000		
Site2:AA5:BB2	0.0	0.000		
Site3:AA1:BB1	12.4	112.659	0.1102	0.912331
Site3:AA1:BB2	0.0	0.000		
Site3:AA2:BB1	39.4	112.659	0.3499	0.726739
Site3:AA2:BB2	0.0	0.000		
Site3:AA3:BB1	49.8	112.659	0.4423	0.658643

Site3:AA3:BB2	0.0	0.000		
Site3:AA4:BB1	32.7	112.659	0.2900	0.772097
Site3:AA4:BB2	0.0	0.000		
Site3:AA5:BB1	0.0	0.000		
Site3:AA5:BB2	0.0	0.000		
Site4:AA1:BB1	0.0	0.000		
Site4:AA1:BB2	0.0	0.000		
Site4:AA2:BB1	0.0	0.000		
Site4:AA2:BB2	0.0	0.000		
Site4:AA3:BB1	0.0	0.000		
Site4:AA3:BB2	0.0	0.000		
Site4:AA4:BB1	0.0	0.000		
Site4:AA4:BB2	0.0	0.000		
Site4:AA5:BB1	0.0	0.000		
Site4:AA5:BB2	0.0	0.000		
Site1:BlockR1:AA1:BB1	15.5	56.329	0.2752	0.783425
Site1:BlockR1:AA1:BB2	-3.5	56.329	-0.0621	0.950507
Site1:BlockR1:AA2:BB1	70.2	56.329	1.2471	0.213567
Site1:BlockR1:AA2:BB2	50.0	56.329	0.8876	0.375626
Site1:BlockR1:AA3:BB1	10.0	56.329	0.1775	0.859244
Site1:BlockR1:AA3:BB2	-62.3	56.329	-1.1051	0.270221
Site1:BlockR1:AA4:BB1	50.5	56.329	0.8965	0.370878
Site1:BlockR1:AA4:BB2	0.0	56.329	0.0000	1.000000
Site1:BlockR1:AA5:BB1	50.0	56.329	0.8876	0.375626
Site1:BlockR1:AA5:BB2	0.0	0.000		
Site1:BlockR2:AA1:BB1	17.2	56.329	0.3062	0.759692
Site1:BlockR2:AA1:BB2	53.7	56.329	0.9542	0.340939
Site1:BlockR2:AA2:BB1	61.7	56.329	1.0962	0.274077
Site1:BlockR2:AA2:BB2	77.7	56.329	1.3803	0.168787
Site1:BlockR2:AA3:BB1	29.0	56.329	0.5148	0.607147
Site1:BlockR2:AA3:BB2	-112.3	56.329	-1.9927	0.047423 *
Site1:BlockR2:AA4:BB1	42.0	56.329	0.7456	0.456631
Site1:BlockR2:AA4:BB2	75.0	56.329	1.3315	0.184303
Site1:BlockR2:AA5:BB1	0.0	56.329	0.0000	1.000000
Site1:BlockR2:AA5:BB2	0.0	0.000		
Site1:BlockR3:AA1:BB1	0.0	0.000		
Site1:BlockR3:AA1:BB2	0.0	0.000		
Site1:BlockR3:AA2:BB1	0.0	0.000		
Site1:BlockR3:AA2:BB2	0.0	0.000		
Site1:BlockR3:AA3:BB1	0.0	0.000		
Site1:BlockR3:AA3:BB2	0.0	0.000		
Site1:BlockR3:AA4:BB1	0.0	0.000		
Site1:BlockR3:AA4:BB2	0.0	0.000		
Site1:BlockR3:AA5:BB1	0.0	0.000		
Site1:BlockR3:AA5:BB2	0.0	0.000		
Site2:BlockR1:AA1:BB1	35.7	56.329	0.6347	0.526255
Site2:BlockR1:AA1:BB2	-32.3	56.329	-0.5725	0.567503
Site2:BlockR1:AA2:BB1	68.5	56.329	1.2161	0.225157

Site2:BlockR1:AA2:BB2	-37.5	56.329	-0.6657	0.506225
Site2:BlockR1:AA3:BB1	-11.0	56.329	-0.1953	0.845339
Site2:BlockR1:AA3:BB2	-30.3	56.329	-0.5370	0.591752
Site2:BlockR1:AA4:BB1	46.2	56.329	0.8211	0.412426
Site2:BlockR1:AA4:BB2	25.0	56.329	0.4438	0.657574
Site2:BlockR1:AA5:BB1	50.0	56.329	0.8876	0.375626
Site2:BlockR1:AA5:BB2	0.0	0.000		
Site2:BlockR2:AA1:BB1	56.7	56.329	1.0075	0.314726
Site2:BlockR2:AA1:BB2	-22.3	56.329	-0.3950	0.693196
Site2:BlockR2:AA2:BB1	32.5	56.329	0.5770	0.564505
Site2:BlockR2:AA2:BB2	-60.0	56.329	-1.0652	0.287873
Site2:BlockR2:AA3:BB1	-1.8	56.329	-0.0311	0.975242
Site2:BlockR2:AA3:BB2	-42.5	56.329	-0.7545	0.451295
Site2:BlockR2:AA4:BB1	22.5	56.329	0.3994	0.689927
Site2:BlockR2:AA4:BB2	50.0	56.329	0.8876	0.375626
Site2:BlockR2:AA5:BB1	50.0	56.329	0.8876	0.375626
Site2:BlockR2:AA5:BB2	0.0	0.000		
Site2:BlockR3:AA1:BB1	0.0	0.000		
Site2:BlockR3:AA1:BB2	0.0	0.000		
Site2:BlockR3:AA2:BB1	0.0	0.000		
Site2:BlockR3:AA2:BB2	0.0	0.000		
Site2:BlockR3:AA3:BB1	0.0	0.000		
Site2:BlockR3:AA3:BB2	0.0	0.000		
Site2:BlockR3:AA4:BB1	0.0	0.000		
Site2:BlockR3:AA4:BB2	0.0	0.000		
Site2:BlockR3:AA5:BB1	0.0	0.000		
Site2:BlockR3:AA5:BB2	0.0	0.000		
Site3:BlockR1:AA1:BB1	17.2	56.329	0.3062	0.759692
Site3:BlockR1:AA1:BB2	-3.8	56.329	-0.0666	0.946977
Site3:BlockR1:AA2:BB1	4.2	56.329	0.0754	0.939920
Site3:BlockR1:AA2:BB2	-1.5	56.329	-0.0266	0.978778
Site3:BlockR1:AA3:BB1	-13.0	56.329	-0.2308	0.817678
Site3:BlockR1:AA3:BB2	50.0	56.329	0.8876	0.375626
Site3:BlockR1:AA4:BB1	-18.0	56.329	-0.3195	0.749589
Site3:BlockR1:AA4:BB2	25.0	56.329	0.4438	0.657574
Site3:BlockR1:AA5:BB1	0.0	56.329	0.0000	1.000000
Site3:BlockR1:AA5:BB2	0.0	0.000		
Site3:BlockR2:AA1:BB1	21.0	56.329	0.3728	0.709621
Site3:BlockR2:AA1:BB2	15.2	56.329	0.2707	0.786832
Site3:BlockR2:AA2:BB1	-5.3	56.329	-0.0932	0.925821
Site3:BlockR2:AA2:BB2	15.7	56.329	0.2796	0.780021
Site3:BlockR2:AA3:BB1	-22.5	56.329	-0.3994	0.689927
Site3:BlockR2:AA3:BB2	75.0	56.329	1.3315	0.184303
Site3:BlockR2:AA4:BB1	-25.8	56.329	-0.4571	0.647990
Site3:BlockR2:AA4:BB2	25.0	56.329	0.4438	0.657574
Site3:BlockR2:AA5:BB1	0.0	56.329	0.0000	1.000000
Site3:BlockR2:AA5:BB2	0.0	0.000		
Site3:BlockR3:AA1:BB1	0.0	0.000		

Site3:BlockR3:AA1:BB2	0.0	0.000		
Site3:BlockR3:AA2:BB1	0.0	0.000		
Site3:BlockR3:AA2:BB2	0.0	0.000		
Site3:BlockR3:AA3:BB1	0.0	0.000		
Site3:BlockR3:AA3:BB2	0.0	0.000		
Site3:BlockR3:AA4:BB1	0.0	0.000		
Site3:BlockR3:AA4:BB2	0.0	0.000		
Site3:BlockR3:AA5:BB1	0.0	0.000		
Site3:BlockR3:AA5:BB2	0.0	0.000		
Site4:BlockR1:AA1:BB1	38.7	56.329	0.6879	0.492169
Site4:BlockR1:AA1:BB2	6.5	56.329	0.1154	0.908230
Site4:BlockR1:AA2:BB1	17.5	56.329	0.3107	0.756319
Site4:BlockR1:AA2:BB2	-13.0	56.329	-0.2308	0.817678
Site4:BlockR1:AA3:BB1	61.5	56.329	1.0918	0.276020
Site4:BlockR1:AA3:BB2	-32.3	56.329	-0.5725	0.567503
Site4:BlockR1:AA4:BB1	33.0	56.329	0.5858	0.558534
Site4:BlockR1:AA4:BB2	25.0	56.329	0.4438	0.657574
Site4:BlockR1:AA5:BB1	75.0	56.329	1.3315	0.184303
Site4:BlockR1:AA5:BB2	0.0	0.000		
Site4:BlockR2:AA1:BB1	-69.8	56.329	-1.2383	0.216833
Site4:BlockR2:AA1:BB2	-36.5	56.329	-0.6480	0.517622
Site4:BlockR2:AA2:BB1	-53.8	56.329	-0.9542	0.340939
Site4:BlockR2:AA2:BB2	-14.3	56.329	-0.2530	0.800503
Site4:BlockR2:AA3:BB1	-62.3	56.329	-1.1051	0.270221
Site4:BlockR2:AA3:BB2	-104.5	56.329	-1.8552	0.064800
Site4:BlockR2:AA4:BB1	-3.8	56.329	-0.0666	0.946977
Site4:BlockR2:AA4:BB2	0.0	56.329	0.0000	1.000000
Site4:BlockR2:AA5:BB1	25.0	56.329	0.4438	0.657574
Site4:BlockR2:AA5:BB2	0.0	0.000		
Site4:BlockR3:AA1:BB1	0.0	0.000		
Site4:BlockR3:AA1:BB2	0.0	0.000		
Site4:BlockR3:AA2:BB1	0.0	0.000		
Site4:BlockR3:AA2:BB2	0.0	0.000		
Site4:BlockR3:AA3:BB1	0.0	0.000		
Site4:BlockR3:AA3:BB2	0.0	0.000		
Site4:BlockR3:AA4:BB1	0.0	0.000		
Site4:BlockR3:AA4:BB2	0.0	0.000		
Site4:BlockR3:AA5:BB1	0.0	0.000		
Site4:BlockR3:AA5:BB2	0.0	0.000		
CC1	-1066.7	45.993	-23.1920	< 2.2e-16 ***
CC2	-733.3	45.993	-15.9445	< 2.2e-16 ***
CC3	-533.3	45.993	-11.5960	< 2.2e-16 ***
CC4	0.0	0.000		
AA1:CC1	1551.3	65.044	23.8506	< 2.2e-16 ***
AA1:CC2	137.7	65.044	2.1165	0.035330 *
AA1:CC3	201.0	65.044	3.0902	0.002236 **
AA1:CC4	0.0	0.000		
AA2:CC1	1877.7	65.044	28.8678	< 2.2e-16 ***

AA2:CC2	1858.7	65.044	28.5757	< 2.2e-16	***
AA2:CC3	1936.7	65.044	29.7749	< 2.2e-16	***
AA2:CC4	0.0	0.000			
AA3:CC1	1915.7	65.044	29.4520	< 2.2e-16	***
AA3:CC2	1315.7	65.044	20.2274	< 2.2e-16	***
AA3:CC3	815.7	65.044	12.5403	< 2.2e-16	***
AA3:CC4	0.0	0.000			
AA4:CC1	-66.7	65.044	-1.0250	0.306418	
AA4:CC2	1200.0	65.044	18.4491	< 2.2e-16	***
AA4:CC3	833.3	65.044	12.8119	< 2.2e-16	***
AA4:CC4	0.0	0.000			
AA5:CC1	0.0	0.000			
AA5:CC2	0.0	0.000			
AA5:CC3	0.0	0.000			
AA5:CC4	0.0	0.000			
BB1:CC1	733.3	65.044	11.2745	< 2.2e-16	***
BB1:CC2	166.7	65.044	2.5624	0.011007	*
BB1:CC3	200.0	65.044	3.0749	0.002350	**
BB1:CC4	0.0	0.000			
BB2:CC1	0.0	0.000			
BB2:CC2	0.0	0.000			
BB2:CC3	0.0	0.000			
BB2:CC4	0.0	0.000			
AA1:BB1:CC1	-2102.0	91.986	-22.8514	< 2.2e-16	***
AA1:BB1:CC2	-122.3	91.986	-1.3299	0.184808	
AA1:BB1:CC3	-116.7	91.986	-1.2683	0.205915	
AA1:BB1:CC4	0.0	0.000			
AA1:BB2:CC1	0.0	0.000			
AA1:BB2:CC2	0.0	0.000			
AA1:BB2:CC3	0.0	0.000			
AA1:BB2:CC4	0.0	0.000			
AA2:BB1:CC1	-2365.3	91.986	-25.7142	< 2.2e-16	***
AA2:BB1:CC2	-1887.7	91.986	-20.5213	< 2.2e-16	***
AA2:BB1:CC3	-1849.3	91.986	-20.1046	< 2.2e-16	***
AA2:BB1:CC4	0.0	0.000			
AA2:BB2:CC1	0.0	0.000			
AA2:BB2:CC2	0.0	0.000			
AA2:BB2:CC3	0.0	0.000			
AA2:BB2:CC4	0.0	0.000			
AA3:BB1:CC1	-4088.7	91.986	-44.4490	< 2.2e-16	***
AA3:BB1:CC2	-2939.3	91.986	-31.9543	< 2.2e-16	***
AA3:BB1:CC3	-2384.3	91.986	-25.9207	< 2.2e-16	***
AA3:BB1:CC4	0.0	0.000			
AA3:BB2:CC1	0.0	0.000			
AA3:BB2:CC2	0.0	0.000			
AA3:BB2:CC3	0.0	0.000			
AA3:BB2:CC4	0.0	0.000			
AA4:BB1:CC1	-561.0	91.986	-6.0988	4.243e-09	***

AA4:BB1:CC2	-1233.3	91.986	-13.4079	< 2.2e-16 ***
AA4:BB1:CC3	-833.3	91.986	-9.0594	< 2.2e-16 ***
AA4:BB1:CC4	0.0	0.000		
AA4:BB2:CC1	0.0	0.000		
AA4:BB2:CC2	0.0	0.000		
AA4:BB2:CC3	0.0	0.000		
AA4:BB2:CC4	0.0	0.000		
AA5:BB1:CC1	0.0	0.000		
AA5:BB1:CC2	0.0	0.000		
AA5:BB1:CC3	0.0	0.000		
AA5:BB1:CC4	0.0	0.000		
AA5:BB2:CC1	0.0	0.000		
AA5:BB2:CC2	0.0	0.000		
AA5:BB2:CC3	0.0	0.000		
AA5:BB2:CC4	0.0	0.000		
Site1:CC1	100.0	65.044	1.5374	0.125506
Site1:CC2	33.3	65.044	0.5125	0.608789
Site1:CC3	0.0	65.044	0.0000	1.000000
Site1:CC4	0.0	0.000		
Site2:CC1	133.3	65.044	2.0499	0.041461 *
Site2:CC2	133.3	65.044	2.0499	0.041461 *
Site2:CC3	66.7	65.044	1.0250	0.306418
Site2:CC4	0.0	0.000		
Site3:CC1	66.7	65.044	1.0250	0.306418
Site3:CC2	0.0	65.044	0.0000	1.000000
Site3:CC3	0.0	65.044	0.0000	1.000000
Site3:CC4	0.0	0.000		
Site4:CC1	0.0	0.000		
Site4:CC2	0.0	0.000		
Site4:CC3	0.0	0.000		
Site4:CC4	0.0	0.000		
Site1:AA1:CC1	-136.7	91.986	-1.4857	0.138660
Site1:AA1:CC2	-33.7	91.986	-0.3660	0.714688
Site1:AA1:CC3	39.0	91.986	0.4240	0.671961
Site1:AA1:CC4	0.0	0.000		
Site1:AA2:CC1	-173.3	91.986	-1.8844	0.060726 .
Site1:AA2:CC2	-174.3	91.986	-1.8952	0.059265 .
Site1:AA2:CC3	0.7	91.986	0.0072	0.994223
Site1:AA2:CC4	0.0	0.000		
Site1:AA3:CC1	-198.7	91.986	-2.1598	0.031782 *
Site1:AA3:CC2	-132.0	91.986	-1.4350	0.152587
Site1:AA3:CC3	-65.3	91.986	-0.7103	0.478235
Site1:AA3:CC4	0.0	0.000		
Site1:AA4:CC1	-33.3	91.986	-0.3624	0.717390
Site1:AA4:CC2	0.0	91.986	0.0000	1.000000
Site1:AA4:CC3	0.0	91.986	0.0000	1.000000
Site1:AA4:CC4	0.0	0.000		
Site1:AA5:CC1	0.0	0.000		

Site1:AA5:CC2	0.0	0.000		
Site1:AA5:CC3	0.0	0.000		
Site1:AA5:CC4	0.0	0.000		
Site2:AA1:CC1	-180.3	91.986	-1.9605	0.051100 .
Site2:AA1:CC2	-81.3	91.986	-0.8842	0.377475
Site2:AA1:CC3	-47.0	91.986	-0.5109	0.609856
Site2:AA1:CC4	0.0	0.000		
Site2:AA2:CC1	-196.7	91.986	-2.1380	0.033526 *
Site2:AA2:CC2	-179.3	91.986	-1.9496	0.052391 .
Site2:AA2:CC3	-124.7	91.986	-1.3553	0.176601
Site2:AA2:CC4	0.0	0.000		
Site2:AA3:CC1	-85.3	91.986	-0.9277	0.354505
Site2:AA3:CC2	-85.3	91.986	-0.9277	0.354505
Site2:AA3:CC3	-52.0	91.986	-0.5653	0.572394
Site2:AA3:CC4	0.0	0.000		
Site2:AA4:CC1	-33.3	91.986	-0.3624	0.717390
Site2:AA4:CC2	0.0	91.986	0.0000	1.000000
Site2:AA4:CC3	33.3	91.986	0.3624	0.717390
Site2:AA4:CC4	0.0	0.000		
Site2:AA5:CC1	0.0	0.000		
Site2:AA5:CC2	0.0	0.000		
Site2:AA5:CC3	0.0	0.000		
Site2:AA5:CC4	0.0	0.000		
Site3:AA1:CC1	-138.7	91.986	-1.5075	0.133002
Site3:AA1:CC2	-83.0	91.986	-0.9023	0.367794
Site3:AA1:CC3	-104.0	91.986	-1.1306	0.259347
Site3:AA1:CC4	0.0	0.000		
Site3:AA2:CC1	-61.7	91.986	-0.6704	0.503251
Site3:AA2:CC2	-71.7	91.986	-0.7791	0.436684
Site3:AA2:CC3	-68.0	91.986	-0.7392	0.460480
Site3:AA2:CC4	0.0	0.000		
Site3:AA3:CC1	-115.7	91.986	-1.2574	0.209816
Site3:AA3:CC2	-15.7	91.986	-0.1703	0.864905
Site3:AA3:CC3	-15.7	91.986	-0.1703	0.864905
Site3:AA3:CC4	0.0	0.000		
Site3:AA4:CC1	33.3	91.986	0.3624	0.717390
Site3:AA4:CC2	0.0	91.986	0.0000	1.000000
Site3:AA4:CC3	33.3	91.986	0.3624	0.717390
Site3:AA4:CC4	0.0	0.000		
Site3:AA5:CC1	0.0	0.000		
Site3:AA5:CC2	0.0	0.000		
Site3:AA5:CC3	0.0	0.000		
Site3:AA5:CC4	0.0	0.000		
Site4:AA1:CC1	0.0	0.000		
Site4:AA1:CC2	0.0	0.000		
Site4:AA1:CC3	0.0	0.000		
Site4:AA1:CC4	0.0	0.000		
Site4:AA2:CC1	0.0	0.000		

Site4:AA2:CC2	0.0	0.000		
Site4:AA2:CC3	0.0	0.000		
Site4:AA2:CC4	0.0	0.000		
Site4:AA3:CC1	0.0	0.000		
Site4:AA3:CC2	0.0	0.000		
Site4:AA3:CC3	0.0	0.000		
Site4:AA3:CC4	0.0	0.000		
Site4:AA4:CC1	0.0	0.000		
Site4:AA4:CC2	0.0	0.000		
Site4:AA4:CC3	0.0	0.000		
Site4:AA4:CC4	0.0	0.000		
Site4:AA5:CC1	0.0	0.000		
Site4:AA5:CC2	0.0	0.000		
Site4:AA5:CC3	0.0	0.000		
Site4:AA5:CC4	0.0	0.000		
Site1:BB1:CC1	0.0	91.986	0.0000	1.000000
Site1:BB1:CC2	33.3	91.986	0.3624	0.717390
Site1:BB1:CC3	33.3	91.986	0.3624	0.717390
Site1:BB1:CC4	0.0	0.000		
Site1:BB2:CC1	0.0	0.000		
Site1:BB2:CC2	0.0	0.000		
Site1:BB2:CC3	0.0	0.000		
Site1:BB2:CC4	0.0	0.000		
Site2:BB1:CC1	-166.7	91.986	-1.8119	0.071255 .
Site2:BB1:CC2	-200.0	91.986	-2.1743	0.030664 *
Site2:BB1:CC3	-233.3	91.986	-2.5366	0.011827 *
Site2:BB1:CC4	0.0	0.000		
Site2:BB2:CC1	0.0	0.000		
Site2:BB2:CC2	0.0	0.000		
Site2:BB2:CC3	0.0	0.000		
Site2:BB2:CC4	0.0	0.000		
Site3:BB1:CC1	33.3	91.986	0.3624	0.717390
Site3:BB1:CC2	33.3	91.986	0.3624	0.717390
Site3:BB1:CC3	-66.7	91.986	-0.7248	0.469311
Site3:BB1:CC4	0.0	0.000		
Site3:BB2:CC1	0.0	0.000		
Site3:BB2:CC2	0.0	0.000		
Site3:BB2:CC3	0.0	0.000		
Site3:BB2:CC4	0.0	0.000		
Site4:BB1:CC1	0.0	0.000		
Site4:BB1:CC2	0.0	0.000		
Site4:BB1:CC3	0.0	0.000		
Site4:BB1:CC4	0.0	0.000		
Site4:BB2:CC1	0.0	0.000		
Site4:BB2:CC2	0.0	0.000		
Site4:BB2:CC3	0.0	0.000		
Site4:BB2:CC4	0.0	0.000		
Site1:AA1:BB1:CC1	76.3	130.087	0.5868	0.557899



Site1:AA1:BB1:CC2	-48.0	130.087	-0.3690	0.712466
Site1:AA1:BB1:CC3	-105.3	130.087	-0.8097	0.418908
Site1:AA1:BB1:CC4	0.0	0.000		
Site1:AA1:BB2:CC1	0.0	0.000		
Site1:AA1:BB2:CC2	0.0	0.000		
Site1:AA1:BB2:CC3	0.0	0.000		
Site1:AA1:BB2:CC4	0.0	0.000		
Site1:AA2:BB1:CC1	12.3	130.087	0.0948	0.924546
Site1:AA2:BB1:CC2	120.0	130.087	0.9225	0.357217
Site1:AA2:BB1:CC3	-23.7	130.087	-0.1819	0.855792
Site1:AA2:BB1:CC4	0.0	0.000		
Site1:AA2:BB2:CC1	0.0	0.000		
Site1:AA2:BB2:CC2	0.0	0.000		
Site1:AA2:BB2:CC3	0.0	0.000		
Site1:AA2:BB2:CC4	0.0	0.000		
Site1:AA3:BB1:CC1	202.7	130.087	1.5579	0.120568
Site1:AA3:BB1:CC2	100.3	130.087	0.7713	0.441302
Site1:AA3:BB1:CC3	29.7	130.087	0.2281	0.819800
Site1:AA3:BB1:CC4	0.0	0.000		
Site1:AA3:BB2:CC1	0.0	0.000		
Site1:AA3:BB2:CC2	0.0	0.000		
Site1:AA3:BB2:CC3	0.0	0.000		
Site1:AA3:BB2:CC4	0.0	0.000		
Site1:AA4:BB1:CC1	-13.7	130.087	-0.1051	0.916418
Site1:AA4:BB1:CC2	-70.0	130.087	-0.5381	0.591007
Site1:AA4:BB1:CC3	-66.7	130.087	-0.5125	0.608789
Site1:AA4:BB1:CC4	0.0	0.000		
Site1:AA4:BB2:CC1	0.0	0.000		
Site1:AA4:BB2:CC2	0.0	0.000		
Site1:AA4:BB2:CC3	0.0	0.000		
Site1:AA4:BB2:CC4	0.0	0.000		
Site1:AA5:BB1:CC1	0.0	0.000		
Site1:AA5:BB1:CC2	0.0	0.000		
Site1:AA5:BB1:CC3	0.0	0.000		
Site1:AA5:BB1:CC4	0.0	0.000		
Site1:AA5:BB2:CC1	0.0	0.000		
Site1:AA5:BB2:CC2	0.0	0.000		
Site1:AA5:BB2:CC3	0.0	0.000		
Site1:AA5:BB2:CC4	0.0	0.000		
Site2:AA1:BB1:CC1	215.3	130.087	1.6553	0.099171
Site2:AA1:BB1:CC2	92.7	130.087	0.7123	0.476945
Site2:AA1:BB1:CC3	122.0	130.087	0.9378	0.349274
Site2:AA1:BB1:CC4	0.0	0.000		
Site2:AA1:BB2:CC1	0.0	0.000		
Site2:AA1:BB2:CC2	0.0	0.000		
Site2:AA1:BB2:CC3	0.0	0.000		
Site2:AA1:BB2:CC4	0.0	0.000		
Site2:AA2:BB1:CC1	143.0	130.087	1.0993	0.272755

Site2:AA2:BB1:CC2	186.0	130.087	1.4298	0.154072
Site2:AA2:BB1:CC3	288.7	130.087	2.2190	0.027421 *
Site2:AA2:BB1:CC4	0.0	0.000		
Site2:AA2:BB2:CC1	0.0	0.000		
Site2:AA2:BB2:CC2	0.0	0.000		
Site2:AA2:BB2:CC3	0.0	0.000		
Site2:AA2:BB2:CC4	0.0	0.000		
Site2:AA3:BB1:CC1	195.7	130.087	1.5041	0.133866
Site2:AA3:BB1:CC2	143.0	130.087	1.0993	0.272755
Site2:AA3:BB1:CC3	203.3	130.087	1.5631	0.119358
Site2:AA3:BB1:CC4	0.0	0.000		
Site2:AA3:BB2:CC1	0.0	0.000		
Site2:AA3:BB2:CC2	0.0	0.000		
Site2:AA3:BB2:CC3	0.0	0.000		
Site2:AA3:BB2:CC4	0.0	0.000		
Site2:AA4:BB1:CC1	136.3	130.087	1.0480	0.295686
Site2:AA4:BB1:CC2	59.0	130.087	0.4535	0.650569
Site2:AA4:BB1:CC3	66.7	130.087	0.5125	0.608789
Site2:AA4:BB1:CC4	0.0	0.000		
Site2:AA4:BB2:CC1	0.0	0.000		
Site2:AA4:BB2:CC2	0.0	0.000		
Site2:AA4:BB2:CC3	0.0	0.000		
Site2:AA4:BB2:CC4	0.0	0.000		
Site2:AA5:BB1:CC1	0.0	0.000		
Site2:AA5:BB1:CC2	0.0	0.000		
Site2:AA5:BB1:CC3	0.0	0.000		
Site2:AA5:BB1:CC4	0.0	0.000		
Site2:AA5:BB2:CC1	0.0	0.000		
Site2:AA5:BB2:CC2	0.0	0.000		
Site2:AA5:BB2:CC3	0.0	0.000		
Site2:AA5:BB2:CC4	0.0	0.000		
Site3:AA1:BB1:CC1	42.0	130.087	0.3229	0.747082
Site3:AA1:BB1:CC2	-74.0	130.087	-0.5688	0.569991
Site3:AA1:BB1:CC3	96.3	130.087	0.7405	0.459703
Site3:AA1:BB1:CC4	0.0	0.000		
Site3:AA1:BB2:CC1	0.0	0.000		
Site3:AA1:BB2:CC2	0.0	0.000		
Site3:AA1:BB2:CC3	0.0	0.000		
Site3:AA1:BB2:CC4	0.0	0.000		
Site3:AA2:BB1:CC1	-113.3	130.087	-0.8712	0.384510
Site3:AA2:BB1:CC2	9.0	130.087	0.0692	0.944901
Site3:AA2:BB1:CC3	83.7	130.087	0.6432	0.520736
Site3:AA2:BB1:CC4	0.0	0.000		
Site3:AA2:BB2:CC1	0.0	0.000		
Site3:AA2:BB2:CC2	0.0	0.000		
Site3:AA2:BB2:CC3	0.0	0.000		
Site3:AA2:BB2:CC4	0.0	0.000		
Site3:AA3:BB1:CC1	36.3	130.087	0.2793	0.780255

Site3:AA3:BB1:CC2	-46.7	130.087	-0.3587	0.720110
Site3:AA3:BB1:CC3	82.0	130.087	0.6303	0.529068
Site3:AA3:BB1:CC4	0.0	0.000		
Site3:AA3:BB2:CC1	0.0	0.000		
Site3:AA3:BB2:CC2	0.0	0.000		
Site3:AA3:BB2:CC3	0.0	0.000		
Site3:AA3:BB2:CC4	0.0	0.000		
Site3:AA4:BB1:CC1	-89.0	130.087	-0.6842	0.494537
Site3:AA4:BB1:CC2	-100.0	130.087	-0.7687	0.442819
Site3:AA4:BB1:CC3	33.3	130.087	0.2562	0.797986
Site3:AA4:BB1:CC4	0.0	0.000		
Site3:AA4:BB2:CC1	0.0	0.000		
Site3:AA4:BB2:CC2	0.0	0.000		
Site3:AA4:BB2:CC3	0.0	0.000		
Site3:AA4:BB2:CC4	0.0	0.000		
Site3:AA5:BB1:CC1	0.0	0.000		
Site3:AA5:BB1:CC2	0.0	0.000		
Site3:AA5:BB1:CC3	0.0	0.000		
Site3:AA5:BB1:CC4	0.0	0.000		
Site3:AA5:BB2:CC1	0.0	0.000		
Site3:AA5:BB2:CC2	0.0	0.000		
Site3:AA5:BB2:CC3	0.0	0.000		
Site3:AA5:BB2:CC4	0.0	0.000		
Site4:AA1:BB1:CC1	0.0	0.000		
Site4:AA1:BB1:CC2	0.0	0.000		
Site4:AA1:BB1:CC3	0.0	0.000		
Site4:AA1:BB1:CC4	0.0	0.000		
Site4:AA1:BB2:CC1	0.0	0.000		
Site4:AA1:BB2:CC2	0.0	0.000		
Site4:AA1:BB2:CC3	0.0	0.000		
Site4:AA1:BB2:CC4	0.0	0.000		
Site4:AA2:BB1:CC1	0.0	0.000		
Site4:AA2:BB1:CC2	0.0	0.000		
Site4:AA2:BB1:CC3	0.0	0.000		
Site4:AA2:BB1:CC4	0.0	0.000		
Site4:AA2:BB2:CC1	0.0	0.000		
Site4:AA2:BB2:CC2	0.0	0.000		
Site4:AA2:BB2:CC3	0.0	0.000		
Site4:AA2:BB2:CC4	0.0	0.000		
Site4:AA3:BB1:CC1	0.0	0.000		
Site4:AA3:BB1:CC2	0.0	0.000		
Site4:AA3:BB1:CC3	0.0	0.000		
Site4:AA3:BB1:CC4	0.0	0.000		
Site4:AA3:BB2:CC1	0.0	0.000		
Site4:AA3:BB2:CC2	0.0	0.000		
Site4:AA3:BB2:CC3	0.0	0.000		
Site4:AA3:BB2:CC4	0.0	0.000		
Site4:AA4:BB1:CC1	0.0	0.000		

```

Site4:AA4:BB1:CC2      0.0      0.000
Site4:AA4:BB1:CC3      0.0      0.000
Site4:AA4:BB1:CC4      0.0      0.000
Site4:AA4:BB2:CC1      0.0      0.000
Site4:AA4:BB2:CC2      0.0      0.000
Site4:AA4:BB2:CC3      0.0      0.000
Site4:AA4:BB2:CC4      0.0      0.000
Site4:AA5:BB1:CC1      0.0      0.000
Site4:AA5:BB1:CC2      0.0      0.000
Site4:AA5:BB1:CC3      0.0      0.000
Site4:AA5:BB1:CC4      0.0      0.000
Site4:AA5:BB2:CC1      0.0      0.000
Site4:AA5:BB2:CC2      0.0      0.000
Site4:AA5:BB2:CC3      0.0      0.000
Site4:AA5:BB2:CC4      0.0      0.000

```

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

```

options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(f10.1, ex10.1), type=3, singular.ok=TRUE) # NOT OK for Site:Block

```

Note: model has aliased coefficients

sums of squares computed by model comparison

Anova Table (Type III tests)

Response: Yield

	Sum Sq	Df	F values	Pr(>F)
Site	552717	3	5.8064e+01	< 2e-16 ***
A	1387680917	4	1.0933e+05	< 2e-16 ***
B	100939695	1	3.1812e+04	< 2e-16 ***
C	19356264	3	2.0334e+03	< 2e-16 ***
Site:Block	0	0		
Site:A	34068	12	8.9470e-01	0.55301
Site:B	1618	3	1.6990e-01	0.91662
A:B	31444008	4	2.4775e+03	< 2e-16 ***
A:C	26075792	12	6.8483e+02	< 2e-16 ***
B:C	23901388	3	2.5109e+03	< 2e-16 ***
Site:C	47625	9	1.6677e+00	0.09747 .
Site:A:B	33737	12	8.8600e-01	0.56185
A:B:C	41996729	12	1.1030e+03	< 2e-16 ***
Site:A:C	104110	36	9.1140e-01	0.61768
Site:B:C	61111	9	2.1400e+00	0.02701 *
Site:Block:A:B	186911	72	8.1810e-01	0.84155
Site:A:B:C	82475	36	7.2200e-01	0.87941
Residuals	761522	240		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 7.15 Example 10.2

(92) MODEL

```
ex10.2 = read.table("C:/G/Rt/Split/Ex10.2-spbsite.txt", header=TRUE)
ex10.2 = af(ex10.2, c("Site", "Block", "A", "B"))
GLM(Yield ~ Site + Site:Block + A + A:Site + A:Site:Block + B + B:Site +
      B:Site:Block + A:B + A:B:Site, ex10.2)
```

\$ANOVA

Response : Yield

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	227	6370995084	28066058	10814	< 2.2e-16 ***
RESIDUALS	252	654049	2595		
CORRECTED TOTAL	479	6371649132			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Site	2	523573968	261786984	1.0086e+05	< 2.2e-16 ***
Site:Block	9	3756646710	417405190	1.6082e+05	< 2.2e-16 ***
A	4	29288163	7322041	2.8211e+03	< 2.2e-16 ***
Site:A	8	247899	30987	1.1939e+01	1.998e-14 ***
Site:Block:A	36	1783391	49539	1.9087e+01	< 2.2e-16 ***
B	7	1937592291	276798899	1.0665e+05	< 2.2e-16 ***
Site:B	14	15903698	1135978	4.3768e+02	< 2.2e-16 ***
Site:Block:B	63	105727288	1678211	6.4660e+02	< 2.2e-16 ***
A:B	28	91141	3255	1.2541e+00	0.1838
Site:A:B	56	140534	2510	9.6690e-01	0.5461

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Site	2	523573968	261786984	1.0086e+05	< 2.2e-16 ***
Site:Block	9	3756646710	417405190	1.6082e+05	< 2.2e-16 ***
A	4	29288163	7322041	2.8211e+03	< 2.2e-16 ***
Site:A	8	247899	30987	1.1939e+01	1.998e-14 ***
Site:Block:A	36	1783391	49539	1.9087e+01	< 2.2e-16 ***
B	7	1937592291	276798899	1.0665e+05	< 2.2e-16 ***
Site:B	14	15903698	1135978	4.3768e+02	< 2.2e-16 ***
Site:Block:B	63	105727288	1678211	6.4660e+02	< 2.2e-16 ***
A:B	28	91141	3255	1.2541e+00	0.1838
Site:A:B	56	140534	2510	9.6690e-01	0.5461

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
Site	2	523573968	261786984	1.0086e+05	< 2.2e-16	***
Site:Block	9	3756646710	417405190	1.6082e+05	< 2.2e-16	***
A	4	29288163	7322041	2.8211e+03	< 2.2e-16	***
Site:A	8	247899	30987	1.1939e+01	1.998e-14	***
Site:Block:A	36	1783391	49539	1.9087e+01	< 2.2e-16	***
B	7	1937592291	276798899	1.0665e+05	< 2.2e-16	***
Site:B	14	15903698	1135978	4.3768e+02	< 2.2e-16	***
Site:Block:B	63	105727288	1678211	6.4660e+02	< 2.2e-16	***
A:B	28	91141	3255	1.2541e+00	0.1838	
Site:A:B	56	140534	2510	9.6690e-01	0.5461	

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Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	13975.4	35.112	398.0266	< 2.2e-16	***
Site1	-3964.6	49.655	-79.8426	< 2.2e-16	***
Site2	-6027.2	49.655	-121.3814	< 2.2e-16	***
Site3	0.0	0.000			
Site1:BlockR1	5969.7	39.462	151.2767	< 2.2e-16	***
Site1:BlockR2	3993.2	39.462	101.1914	< 2.2e-16	***
Site1:BlockR3	7976.0	39.462	202.1185	< 2.2e-16	***
Site1:BlockR4	0.0	0.000			
Site2:BlockR1	1983.1	39.462	50.2533	< 2.2e-16	***
Site2:BlockR2	8050.7	39.462	204.0115	< 2.2e-16	***
Site2:BlockR3	9979.6	39.462	252.8913	< 2.2e-16	***
Site2:BlockR4	0.0	0.000			
Site3:BlockR1	-1977.8	39.462	-50.1183	< 2.2e-16	***
Site3:BlockR2	4028.8	39.462	102.0941	< 2.2e-16	***
Site3:BlockR3	6011.4	39.462	152.3335	< 2.2e-16	***
Site3:BlockR4	0.0	0.000			
AA1	-558.7	42.242	-13.2267	< 2.2e-16	***
AA2	-438.8	42.242	-10.3889	< 2.2e-16	***
AA3	-240.1	42.242	-5.6838	3.632e-08	***
AA4	-153.3	42.242	-3.6279	0.0003458	***
AA5	0.0	0.000			
Site1:AA1	-38.1	59.739	-0.6377	0.5242659	
Site1:AA2	0.8	59.739	0.0131	0.9895761	
Site1:AA3	-98.2	59.739	-1.6436	0.1015027	
Site1:AA4	-21.4	59.739	-0.3583	0.7203955	
Site1:AA5	0.0	0.000			
Site2:AA1	413.1	59.739	6.9145	3.844e-11	***
Site2:AA2	368.4	59.739	6.1670	2.752e-09	***
Site2:AA3	138.4	59.739	2.3163	0.0213427	*
Site2:AA4	164.4	59.739	2.7516	0.0063618	**

Site2:AA5	0.0	0.000				
Site3:AA1	0.0	0.000				
Site3:AA2	0.0	0.000				
Site3:AA3	0.0	0.000				
Site3:AA4	0.0	0.000				
Site3:AA5	0.0	0.000				
Site1:BlockR1:AA1	-190.6	36.024	-5.2916	2.635e-07	***	
Site1:BlockR1:AA2	-131.1	36.024	-3.6400	0.0003308	***	
Site1:BlockR1:AA3	-76.1	36.024	-2.1132	0.0355682	*	
Site1:BlockR1:AA4	-52.6	36.024	-1.4608	0.1453053		
Site1:BlockR1:AA5	0.0	0.000				
Site1:BlockR2:AA1	-188.1	36.024	-5.2222	3.702e-07	***	
Site1:BlockR2:AA2	-148.4	36.024	-4.1188	5.168e-05	***	
Site1:BlockR2:AA3	-43.6	36.024	-1.2110	0.2270282		
Site1:BlockR2:AA4	-33.0	36.024	-0.9161	0.3605109		
Site1:BlockR2:AA5	0.0	0.000				
Site1:BlockR3:AA1	-234.0	36.024	-6.4957	4.379e-10	***	
Site1:BlockR3:AA2	-133.3	36.024	-3.6989	0.0002658	***	
Site1:BlockR3:AA3	-82.1	36.024	-2.2797	0.0234592	*	
Site1:BlockR3:AA4	-87.8	36.024	-2.4359	0.0155490	*	
Site1:BlockR3:AA5	0.0	0.000				
Site1:BlockR4:AA1	0.0	0.000				
Site1:BlockR4:AA2	0.0	0.000				
Site1:BlockR4:AA3	0.0	0.000				
Site1:BlockR4:AA4	0.0	0.000				
Site1:BlockR4:AA5	0.0	0.000				
Site2:BlockR1:AA1	-382.5	36.024	-10.6180	< 2.2e-16	***	
Site2:BlockR1:AA2	-261.9	36.024	-7.2695	4.528e-12	***	
Site2:BlockR1:AA3	-171.6	36.024	-4.7642	3.204e-06	***	
Site2:BlockR1:AA4	-74.5	36.024	-2.0681	0.0396533	*	
Site2:BlockR1:AA5	0.0	0.000				
Site2:BlockR2:AA1	-634.4	36.024	-17.6099	< 2.2e-16	***	
Site2:BlockR2:AA2	-508.7	36.024	-14.1226	< 2.2e-16	***	
Site2:BlockR2:AA3	-288.9	36.024	-8.0190	3.997e-14	***	
Site2:BlockR2:AA4	-183.6	36.024	-5.0973	6.768e-07	***	
Site2:BlockR2:AA5	0.0	0.000				
Site2:BlockR3:AA1	-607.5	36.024	-16.8638	< 2.2e-16	***	
Site2:BlockR3:AA2	-466.6	36.024	-12.9532	< 2.2e-16	***	
Site2:BlockR3:AA3	-249.6	36.024	-6.9294	3.517e-11	***	
Site2:BlockR3:AA4	-166.4	36.024	-4.6185	6.169e-06	***	
Site2:BlockR3:AA5	0.0	0.000				
Site2:BlockR4:AA1	0.0	0.000				
Site2:BlockR4:AA2	0.0	0.000				
Site2:BlockR4:AA3	0.0	0.000				
Site2:BlockR4:AA4	0.0	0.000				
Site2:BlockR4:AA5	0.0	0.000				
Site3:BlockR1:AA1	11.6	36.024	0.3227	0.7471876		
Site3:BlockR1:AA2	-27.1	36.024	-0.7530	0.4521683		

Site3:BlockR1:AA3	-8.9	36.024	-0.2464	0.8056004	
Site3:BlockR1:AA4	51.3	36.024	1.4227	0.1560685	
Site3:BlockR1:AA5	0.0	0.000			
Site3:BlockR2:AA1	-237.6	36.024	-6.5963	2.463e-10	***
Site3:BlockR2:AA2	-200.2	36.024	-5.5588	6.907e-08	***
Site3:BlockR2:AA3	-142.0	36.024	-3.9418	0.0001048	***
Site3:BlockR2:AA4	-55.4	36.024	-1.5372	0.1255045	
Site3:BlockR2:AA5	0.0	0.000			
Site3:BlockR3:AA1	-207.1	36.024	-5.7497	2.578e-08	***
Site3:BlockR3:AA2	-232.2	36.024	-6.4471	5.769e-10	***
Site3:BlockR3:AA3	-127.7	36.024	-3.5463	0.0004657	***
Site3:BlockR3:AA4	-66.9	36.024	-1.8564	0.0645621	.
Site3:BlockR3:AA5	0.0	0.000			
Site3:BlockR4:AA1	0.0	0.000			
Site3:BlockR4:AA2	0.0	0.000			
Site3:BlockR4:AA3	0.0	0.000			
Site3:BlockR4:AA4	0.0	0.000			
Site3:BlockR4:AA5	0.0	0.000			
BB1	-5364.0	45.567	-117.7159	< 2.2e-16	***
BB2	-4564.7	45.567	-100.1746	< 2.2e-16	***
BB3	-3808.6	45.567	-83.5815	< 2.2e-16	***
BB4	-3070.7	45.567	-67.3877	< 2.2e-16	***
BB5	-2308.1	45.567	-50.6519	< 2.2e-16	***
BB6	-1561.6	45.567	-34.2694	< 2.2e-16	***
BB7	-704.7	45.567	-15.4641	< 2.2e-16	***
BB8	0.0	0.000			
Site1:BB1	-87.2	64.441	-1.3539	0.1769672	
Site1:BB2	-63.8	64.441	-0.9900	0.3231006	
Site1:BB3	-48.9	64.441	-0.7588	0.4486638	
Site1:BB4	-16.6	64.441	-0.2576	0.7969270	
Site1:BB5	17.3	64.441	0.2677	0.7891606	
Site1:BB6	16.3	64.441	0.2529	0.8005184	
Site1:BB7	-127.0	64.441	-1.9716	0.0497538	*
Site1:BB8	0.0	0.000			
Site2:BB1	3583.2	64.441	55.6033	< 2.2e-16	***
Site2:BB2	3099.2	64.441	48.0926	< 2.2e-16	***
Site2:BB3	2577.7	64.441	39.9999	< 2.2e-16	***
Site2:BB4	2111.0	64.441	32.7585	< 2.2e-16	***
Site2:BB5	1589.0	64.441	24.6581	< 2.2e-16	***
Site2:BB6	1116.0	64.441	17.3173	< 2.2e-16	***
Site2:BB7	555.1	64.441	8.6133	8.882e-16	***
Site2:BB8	0.0	0.000			
Site3:BB1	0.0	0.000			
Site3:BB2	0.0	0.000			
Site3:BB3	0.0	0.000			
Site3:BB4	0.0	0.000			
Site3:BB5	0.0	0.000			
Site3:BB6	0.0	0.000			



Site3:BB7	0.0	0.000			
Site3:BB8	0.0	0.000			
Site1:BlockR1:BB1	-1733.0	45.567	-38.0320	< 2.2e-16	***
Site1:BlockR1:BB2	-1498.6	45.567	-32.8879	< 2.2e-16	***
Site1:BlockR1:BB3	-1281.4	45.567	-28.1213	< 2.2e-16	***
Site1:BlockR1:BB4	-984.4	45.567	-21.6034	< 2.2e-16	***
Site1:BlockR1:BB5	-743.6	45.567	-16.3189	< 2.2e-16	***
Site1:BlockR1:BB6	-499.4	45.567	-10.9597	< 2.2e-16	***
Site1:BlockR1:BB7	-196.2	45.567	-4.3058	2.385e-05	***
Site1:BlockR1:BB8	0.0	0.000			
Site1:BlockR2:BB1	-1721.2	45.567	-37.7730	< 2.2e-16	***
Site1:BlockR2:BB2	-1606.0	45.567	-35.2449	< 2.2e-16	***
Site1:BlockR2:BB3	-1267.6	45.567	-27.8184	< 2.2e-16	***
Site1:BlockR2:BB4	-1005.4	45.567	-22.0642	< 2.2e-16	***
Site1:BlockR2:BB5	-800.4	45.567	-17.5654	< 2.2e-16	***
Site1:BlockR2:BB6	-486.4	45.567	-10.6744	< 2.2e-16	***
Site1:BlockR2:BB7	-233.8	45.567	-5.1309	5.761e-07	***
Site1:BlockR2:BB8	0.0	0.000			
Site1:BlockR3:BB1	-1709.0	45.567	-37.5053	< 2.2e-16	***
Site1:BlockR3:BB2	-1522.6	45.567	-33.4146	< 2.2e-16	***
Site1:BlockR3:BB3	-1220.2	45.567	-26.7782	< 2.2e-16	***
Site1:BlockR3:BB4	-965.2	45.567	-21.1820	< 2.2e-16	***
Site1:BlockR3:BB5	-767.8	45.567	-16.8499	< 2.2e-16	***
Site1:BlockR3:BB6	-476.2	45.567	-10.4506	< 2.2e-16	***
Site1:BlockR3:BB7	-220.2	45.567	-4.8325	2.345e-06	***
Site1:BlockR3:BB8	0.0	0.000			
Site1:BlockR4:BB1	0.0	0.000			
Site1:BlockR4:BB2	0.0	0.000			
Site1:BlockR4:BB3	0.0	0.000			
Site1:BlockR4:BB4	0.0	0.000			
Site1:BlockR4:BB5	0.0	0.000			
Site1:BlockR4:BB6	0.0	0.000			
Site1:BlockR4:BB7	0.0	0.000			
Site1:BlockR4:BB8	0.0	0.000			
Site2:BlockR1:BB1	-3519.6	45.567	-77.2402	< 2.2e-16	***
Site2:BlockR1:BB2	-3097.8	45.567	-67.9835	< 2.2e-16	***
Site2:BlockR1:BB3	-2563.0	45.567	-56.2469	< 2.2e-16	***
Site2:BlockR1:BB4	-2044.0	45.567	-44.8571	< 2.2e-16	***
Site2:BlockR1:BB5	-1539.6	45.567	-33.7877	< 2.2e-16	***
Site2:BlockR1:BB6	-1052.8	45.567	-23.1045	< 2.2e-16	***
Site2:BlockR1:BB7	-552.0	45.567	-12.1141	< 2.2e-16	***
Site2:BlockR1:BB8	0.0	0.000			
Site2:BlockR2:BB1	-5360.8	45.567	-117.6467	< 2.2e-16	***
Site2:BlockR2:BB2	-4648.0	45.567	-102.0038	< 2.2e-16	***
Site2:BlockR2:BB3	-3890.2	45.567	-85.3733	< 2.2e-16	***
Site2:BlockR2:BB4	-3094.2	45.567	-67.9045	< 2.2e-16	***
Site2:BlockR2:BB5	-2335.6	45.567	-51.2565	< 2.2e-16	***
Site2:BlockR2:BB6	-1556.2	45.567	-34.1520	< 2.2e-16	***

Site2:BlockR2:BB7	-830.8	45.567	-18.2325	< 2.2e-16	***
Site2:BlockR2:BB8	0.0	0.000			
Site2:BlockR3:BB1	-5309.4	45.567	-116.5187	< 2.2e-16	***
Site2:BlockR3:BB2	-4604.2	45.567	-101.0426	< 2.2e-16	***
Site2:BlockR3:BB3	-3827.2	45.567	-83.9907	< 2.2e-16	***
Site2:BlockR3:BB4	-3058.2	45.567	-67.1145	< 2.2e-16	***
Site2:BlockR3:BB5	-2281.6	45.567	-50.0714	< 2.2e-16	***
Site2:BlockR3:BB6	-1466.6	45.567	-32.1856	< 2.2e-16	***
Site2:BlockR3:BB7	-795.8	45.567	-17.4644	< 2.2e-16	***
Site2:BlockR3:BB8	0.0	0.000			
Site2:BlockR4:BB1	0.0	0.000			
Site2:BlockR4:BB2	0.0	0.000			
Site2:BlockR4:BB3	0.0	0.000			
Site2:BlockR4:BB4	0.0	0.000			
Site2:BlockR4:BB5	0.0	0.000			
Site2:BlockR4:BB6	0.0	0.000			
Site2:BlockR4:BB7	0.0	0.000			
Site2:BlockR4:BB8	0.0	0.000			
Site3:BlockR1:BB1	-7.4	45.567	-0.1624	0.8711222	
Site3:BlockR1:BB2	26.4	45.567	0.5794	0.5628587	
Site3:BlockR1:BB3	-48.4	45.567	-1.0622	0.2891736	
Site3:BlockR1:BB4	-67.6	45.567	-1.4835	0.1391827	
Site3:BlockR1:BB5	-35.0	45.567	-0.7681	0.4431463	
Site3:BlockR1:BB6	-8.2	45.567	-0.1800	0.8573324	
Site3:BlockR1:BB7	-66.6	45.567	-1.4616	0.1451004	
Site3:BlockR1:BB8	0.0	0.000			
Site3:BlockR2:BB1	-1771.4	45.567	-38.8747	< 2.2e-16	***
Site3:BlockR2:BB2	-1533.8	45.567	-33.6604	< 2.2e-16	***
Site3:BlockR2:BB3	-1295.8	45.567	-28.4373	< 2.2e-16	***
Site3:BlockR2:BB4	-1082.6	45.567	-23.7585	< 2.2e-16	***
Site3:BlockR2:BB5	-796.0	45.567	-17.4688	< 2.2e-16	***
Site3:BlockR2:BB6	-482.0	45.567	-10.5778	< 2.2e-16	***
Site3:BlockR2:BB7	-304.2	45.567	-6.6759	1.556e-10	***
Site3:BlockR2:BB8	0.0	0.000			
Site3:BlockR3:BB1	-1772.4	45.567	-38.8966	< 2.2e-16	***
Site3:BlockR3:BB2	-1509.0	45.567	-33.1161	< 2.2e-16	***
Site3:BlockR3:BB3	-1281.6	45.567	-28.1257	< 2.2e-16	***
Site3:BlockR3:BB4	-1013.2	45.567	-22.2354	< 2.2e-16	***
Site3:BlockR3:BB5	-751.8	45.567	-16.4988	< 2.2e-16	***
Site3:BlockR3:BB6	-462.6	45.567	-10.1521	< 2.2e-16	***
Site3:BlockR3:BB7	-248.6	45.567	-5.4557	1.165e-07	***
Site3:BlockR3:BB8	0.0	0.000			
Site3:BlockR4:BB1	0.0	0.000			
Site3:BlockR4:BB2	0.0	0.000			
Site3:BlockR4:BB3	0.0	0.000			
Site3:BlockR4:BB4	0.0	0.000			
Site3:BlockR4:BB5	0.0	0.000			
Site3:BlockR4:BB6	0.0	0.000			

Site3:BlockR4:BB7	0.0	0.000		
Site3:BlockR4:BB8	0.0	0.000		
AA1:BB1	-61.5	50.945	-1.2072	0.2284965
AA1:BB2	-140.0	50.945	-2.7480	0.0064285 **
AA1:BB3	-57.7	50.945	-1.1336	0.2580534
AA1:BB4	-29.2	50.945	-0.5741	0.5663822
AA1:BB5	-66.7	50.945	-1.3102	0.1913120
AA1:BB6	-41.5	50.945	-0.8146	0.4160716
AA1:BB7	-40.5	50.945	-0.7950	0.4273795
AA1:BB8	0.0	0.000		
AA2:BB1	-32.5	50.945	-0.6379	0.5240931
AA2:BB2	-62.7	50.945	-1.2317	0.2192050
AA2:BB3	-59.0	50.945	-1.1581	0.2479183
AA2:BB4	51.8	50.945	1.0158	0.3107018
AA2:BB5	3.8	50.945	0.0736	0.9413805
AA2:BB6	8.3	50.945	0.1619	0.8714843
AA2:BB7	6.3	50.945	0.1227	0.9024579
AA2:BB8	0.0	0.000		
AA3:BB1	-90.0	50.945	-1.7666	0.0785061 .
AA3:BB2	-122.7	50.945	-2.4094	0.0166946 *
AA3:BB3	-110.0	50.945	-2.1592	0.0317805 *
AA3:BB4	-63.0	50.945	-1.2366	0.2173799
AA3:BB5	-36.7	50.945	-0.7214	0.4713562
AA3:BB6	-11.5	50.945	-0.2257	0.8215928
AA3:BB7	-104.2	50.945	-2.0463	0.0417637 *
AA3:BB8	0.0	0.000		
AA4:BB1	-66.2	50.945	-1.3004	0.1946476
AA4:BB2	-60.2	50.945	-1.1826	0.2380667
AA4:BB3	-7.5	50.945	-0.1472	0.8830788
AA4:BB4	3.8	50.945	0.0736	0.9413805
AA4:BB5	12.0	50.945	0.2355	0.8139760
AA4:BB6	14.5	50.945	0.2846	0.7761701
AA4:BB7	-37.2	50.945	-0.7312	0.4653514
AA4:BB8	0.0	0.000		
AA5:BB1	0.0	0.000		
AA5:BB2	0.0	0.000		
AA5:BB3	0.0	0.000		
AA5:BB4	0.0	0.000		
AA5:BB5	0.0	0.000		
AA5:BB6	0.0	0.000		
AA5:BB7	0.0	0.000		
AA5:BB8	0.0	0.000		
Site1:AA1:BB1	67.2	72.048	0.9334	0.3515017
Site1:AA1:BB2	118.7	72.048	1.6482	0.1005547
Site1:AA1:BB3	49.7	72.048	0.6905	0.4905056
Site1:AA1:BB4	-13.0	72.048	-0.1804	0.8569552
Site1:AA1:BB5	77.7	72.048	1.0791	0.2815539
Site1:AA1:BB6	10.5	72.048	0.1457	0.8842456

Site1:AA1:BB7	48.7	72.048	0.6766	0.4992577	
Site1:AA1:BB8	0.0	0.000			
Site1:AA2:BB1	47.5	72.048	0.6593	0.5103141	
Site1:AA2:BB2	75.5	72.048	1.0479	0.2956805	
Site1:AA2:BB3	35.2	72.048	0.4893	0.6250835	
Site1:AA2:BB4	-56.8	72.048	-0.7877	0.4316280	
Site1:AA2:BB5	-52.5	72.048	-0.7287	0.4668712	
Site1:AA2:BB6	-57.3	72.048	-0.7946	0.4275862	
Site1:AA2:BB7	-7.0	72.048	-0.0972	0.9226782	
Site1:AA2:BB8	0.0	0.000			
Site1:AA3:BB1	172.0	72.048	2.3873	0.0177101	*
Site1:AA3:BB2	116.0	72.048	1.6100	0.1086397	
Site1:AA3:BB3	123.2	72.048	1.7107	0.0883720	.
Site1:AA3:BB4	21.0	72.048	0.2915	0.7709287	
Site1:AA3:BB5	64.7	72.048	0.8987	0.3696645	
Site1:AA3:BB6	-24.3	72.048	-0.3366	0.7367115	
Site1:AA3:BB7	182.7	72.048	2.5365	0.0118006	*
Site1:AA3:BB8	0.0	0.000			
Site1:AA4:BB1	104.5	72.048	1.4504	0.1481824	
Site1:AA4:BB2	95.7	72.048	1.3290	0.1850560	
Site1:AA4:BB3	73.2	72.048	1.0167	0.3102767	
Site1:AA4:BB4	9.7	72.048	0.1353	0.8924613	
Site1:AA4:BB5	-17.3	72.048	-0.2394	0.8109707	
Site1:AA4:BB6	-30.5	72.048	-0.4233	0.6724148	
Site1:AA4:BB7	141.7	72.048	1.9674	0.0502283	.
Site1:AA4:BB8	0.0	0.000			
Site1:AA5:BB1	0.0	0.000			
Site1:AA5:BB2	0.0	0.000			
Site1:AA5:BB3	0.0	0.000			
Site1:AA5:BB4	0.0	0.000			
Site1:AA5:BB5	0.0	0.000			
Site1:AA5:BB6	0.0	0.000			
Site1:AA5:BB7	0.0	0.000			
Site1:AA5:BB8	0.0	0.000			
Site2:AA1:BB1	-11.8	72.048	-0.1631	0.8705810	
Site2:AA1:BB2	106.7	72.048	1.4817	0.1396805	
Site2:AA1:BB3	8.7	72.048	0.1214	0.9034334	
Site2:AA1:BB4	-57.5	72.048	-0.7981	0.4255737	
Site2:AA1:BB5	17.5	72.048	0.2429	0.8082844	
Site2:AA1:BB6	-26.3	72.048	-0.3643	0.7159080	
Site2:AA1:BB7	-30.0	72.048	-0.4164	0.6774782	
Site2:AA1:BB8	0.0	0.000			
Site2:AA2:BB1	-89.5	72.048	-1.2422	0.2153051	
Site2:AA2:BB2	-74.3	72.048	-1.0306	0.3037314	
Site2:AA2:BB3	-32.3	72.048	-0.4476	0.6548116	
Site2:AA2:BB4	-151.8	72.048	-2.1062	0.0361722	*
Site2:AA2:BB5	-127.5	72.048	-1.7697	0.0779927	.
Site2:AA2:BB6	-163.5	72.048	-2.2693	0.0240938	*

Site2:AA2:BB7	-127.5	72.048	-1.7697	0.0779927	.
Site2:AA2:BB8	0.0	0.000			
Site2:AA3:BB1	57.7	72.048	0.8016	0.4235667	
Site2:AA3:BB2	82.0	72.048	1.1381	0.2561446	
Site2:AA3:BB3	95.2	72.048	1.3220	0.1873529	
Site2:AA3:BB4	-32.0	72.048	-0.4442	0.6573149	
Site2:AA3:BB5	60.2	72.048	0.8363	0.4038052	
Site2:AA3:BB6	-45.0	72.048	-0.6246	0.5328074	
Site2:AA3:BB7	69.7	72.048	0.9681	0.3339179	
Site2:AA3:BB8	0.0	0.000			
Site2:AA4:BB1	-22.3	72.048	-0.3088	0.7577110	
Site2:AA4:BB2	-49.3	72.048	-0.6836	0.4948713	
Site2:AA4:BB3	-4.0	72.048	-0.0555	0.9557691	
Site2:AA4:BB4	-57.8	72.048	-0.8016	0.4235667	
Site2:AA4:BB5	-81.3	72.048	-1.1277	0.2605082	
Site2:AA4:BB6	-111.0	72.048	-1.5406	0.1246574	
Site2:AA4:BB7	-65.5	72.048	-0.9091	0.3641550	
Site2:AA4:BB8	0.0	0.000			
Site2:AA5:BB1	0.0	0.000			
Site2:AA5:BB2	0.0	0.000			
Site2:AA5:BB3	0.0	0.000			
Site2:AA5:BB4	0.0	0.000			
Site2:AA5:BB5	0.0	0.000			
Site2:AA5:BB6	0.0	0.000			
Site2:AA5:BB7	0.0	0.000			
Site2:AA5:BB8	0.0	0.000			
Site3:AA1:BB1	0.0	0.000			
Site3:AA1:BB2	0.0	0.000			
Site3:AA1:BB3	0.0	0.000			
Site3:AA1:BB4	0.0	0.000			
Site3:AA1:BB5	0.0	0.000			
Site3:AA1:BB6	0.0	0.000			
Site3:AA1:BB7	0.0	0.000			
Site3:AA1:BB8	0.0	0.000			
Site3:AA2:BB1	0.0	0.000			
Site3:AA2:BB2	0.0	0.000			
Site3:AA2:BB3	0.0	0.000			
Site3:AA2:BB4	0.0	0.000			
Site3:AA2:BB5	0.0	0.000			
Site3:AA2:BB6	0.0	0.000			
Site3:AA2:BB7	0.0	0.000			
Site3:AA2:BB8	0.0	0.000			
Site3:AA3:BB1	0.0	0.000			
Site3:AA3:BB2	0.0	0.000			
Site3:AA3:BB3	0.0	0.000			
Site3:AA3:BB4	0.0	0.000			
Site3:AA3:BB5	0.0	0.000			
Site3:AA3:BB6	0.0	0.000			

Site3:AA3:BB7	0.0	0.000
Site3:AA3:BB8	0.0	0.000
Site3:AA4:BB1	0.0	0.000
Site3:AA4:BB2	0.0	0.000
Site3:AA4:BB3	0.0	0.000
Site3:AA4:BB4	0.0	0.000
Site3:AA4:BB5	0.0	0.000
Site3:AA4:BB6	0.0	0.000
Site3:AA4:BB7	0.0	0.000
Site3:AA4:BB8	0.0	0.000
Site3:AA5:BB1	0.0	0.000
Site3:AA5:BB2	0.0	0.000
Site3:AA5:BB3	0.0	0.000
Site3:AA5:BB4	0.0	0.000
Site3:AA5:BB5	0.0	0.000
Site3:AA5:BB6	0.0	0.000
Site3:AA5:BB7	0.0	0.000
Site3:AA5:BB8	0.0	0.000

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 7.16 Example 11.1

(93) MODEL

```
ex11.1 = read.table("C:/G/Rt/Split/Ex11.1-cov.txt", header=TRUE)
ex11.1 = af(ex11.1, c("R", "T", "S"))
GLM(Y ~ R + T + R:T + S + S:T, ex11.1)
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	11	328	29.8182	3.1948	0.02875 *
RESIDUALS	12	112	9.3333		
CORRECTED TOTAL	23	440			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	48	24	2.5714	0.11765
T	1	24	24	2.5714	0.13479
R:T	2	16	8	0.8571	0.44880
S	3	156	52	5.5714	0.01251 *
T:S	3	84	28	3.0000	0.07277 .

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	48	24	2.5714	0.11765
T	1	24	24	2.5714	0.13479
R:T	2	16	8	0.8571	0.44880
S	3	156	52	5.5714	0.01251 *
T:S	3	84	28	3.0000	0.07277 .

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	48	24	2.5714	0.11765
T	1	24	24	2.5714	0.13479
R:T	2	16	8	0.8571	0.44880
S	3	156	52	5.5714	0.01251 *
T:S	3	84	28	3.0000	0.07277 .

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	17	2.1602	7.8695	4.448e-06 ***
R1	-5	2.1602	-2.3146	0.0391521 *
R2	-1	2.1602	-0.4629	0.6517110
R3	0	0.0000		
T1	-10	3.0551	-3.2733	0.0066627 **
T2	0	0.0000		
R1:T1	4	3.0551	1.3093	0.2149461
R1:T2	0	0.0000		
R2:T1	2	3.0551	0.6547	0.5250404
R2:T2	0	0.0000		
R3:T1	0	0.0000		
R3:T2	0	0.0000		
S1	-8	2.4944	-3.2071	0.0075321 **
S2	-9	2.4944	-3.6080	0.0035926 **
S3	-11	2.4944	-4.4098	0.0008506 ***
S4	0	0.0000		
T1:S1	6	3.5277	1.7008	0.1147185
T1:S2	10	3.5277	2.8347	0.0150430 *
T1:S3	8	3.5277	2.2678	0.0426079 *
T1:S4	0	0.0000		
T2:S1	0	0.0000		
T2:S2	0	0.0000		
T2:S3	0	0.0000		
T2:S4	0	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

(94) MODEL

```
GLM(Z ~ R + T + R:T + S + S:T, ex11.1)
```

\$ANOVA

Response : Z

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	11	46	4.1818	2.5091	0.06452 .
RESIDUALS	12	20	1.6667		
CORRECTED TOTAL	23	66			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	9	4.5	2.7	0.1076
T	1	6	6.0	3.6	0.0821 .
R:T	2	1	0.5	0.3	0.7462
S	3	9	3.0	1.8	0.2008
T:S	3	21	7.0	4.2	0.0301 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	9	4.5	2.7	0.1076
T	1	6	6.0	3.6	0.0821 .
R:T	2	1	0.5	0.3	0.7462
S	3	9	3.0	1.8	0.2008
T:S	3	21	7.0	4.2	0.0301 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	9	4.5	2.7	0.1076
T	1	6	6.0	3.6	0.0821 .
R:T	2	1	0.5	0.3	0.7462
S	3	9	3.0	1.8	0.2008
T:S	3	21	7.0	4.2	0.0301 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter



	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	6.0	0.91287	6.5727	2.641e-05	***
R1	-2.0	0.91287	-2.1909	0.048930	*
R2	-1.0	0.91287	-1.0954	0.294821	
R3	0.0	0.00000			
T1	-3.5	1.29099	-2.7111	0.018917	*
T2	0.0	0.00000			
R1:T1	1.0	1.29099	0.7746	0.453571	
R1:T2	0.0	0.00000			
R2:T1	0.5	1.29099	0.3873	0.705317	
R2:T2	0.0	0.00000			
R3:T1	0.0	0.00000			
R3:T2	0.0	0.00000			
S1	-2.0	1.05409	-1.8974	0.082097	.
S2	-4.0	1.05409	-3.7947	0.002554	**
S3	-2.0	1.05409	-1.8974	0.082097	.
S4	0.0	0.00000			
T1:S1	2.0	1.49071	1.3416	0.204550	
T1:S2	5.0	1.49071	3.3541	0.005736	**
T1:S3	1.0	1.49071	0.6708	0.515039	
T1:S4	0.0	0.00000			
T2:S1	0.0	0.00000			
T2:S2	0.0	0.00000			
T2:S3	0.0	0.00000			
T2:S4	0.0	0.00000			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

(95) MODEL

```
GLM(Y ~ R + T + R:T + S + S:T + Z, ex11.1)
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	12	342.45	28.5375	3.218	0.03116 *
RESIDUALS	11	97.55	8.8682		
CORRECTED TOTAL	23	440.00			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	2	48.00	24.00	2.7063	0.11071
T	1	24.00	24.00	2.7063	0.12820
R:T	2	16.00	8.00	0.9021	0.43373
S	3	156.00	52.00	5.8637	0.01211 *

```
T:S  3  84.00   28.00   3.1574 0.06828 .
Z    1  14.45   14.45   1.6294 0.22807
```

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
```

```
      Df Sum Sq Mean Sq F value Pr(>F)
R      2 18.300   9.1500   1.0318 0.38844
T      1  2.679   2.6786   0.3020 0.59359
R:T    2  9.450   4.7250   0.5328 0.60137
S      3 79.196  26.3985   2.9768 0.07822 .
T:S    3 37.474  12.4915   1.4086 0.29234
Z      1 14.450  14.4500   1.6294 0.22807
```

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
```

```
      Df Sum Sq Mean Sq F value Pr(>F)
R      2 20.209  10.1043   1.1394 0.35505
T      1  6.104   6.1038   0.6883 0.42439
R:T    2  9.450   4.7250   0.5328 0.60137
S      3 84.243  28.0810   3.1665 0.06782 .
T:S    3 37.474  12.4915   1.4086 0.29234
Z      1 14.450  14.4500   1.6294 0.22807
```

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
```

```
      Estimate Std. Error t value Pr(>|t|)
(Intercept)  11.900      4.5163   2.6349 0.023203 *
R1            -3.300      2.4915  -1.3245 0.212200
R2            -0.150      2.2085  -0.0679 0.947069
R3             0.000      0.0000
T1            -7.025      3.7815  -1.8577 0.090160 .
T2             0.000      0.0000
R1:T1          3.150      3.0515   1.0323 0.324102
R1:T2          0.000      0.0000
R2:T1          1.575      2.9965   0.5256 0.609590
R2:T2          0.000      0.0000
R3:T1          0.000      0.0000
R3:T2          0.000      0.0000
S1            -6.300      2.7723  -2.2725 0.044116 *
S2            -5.600      3.6065  -1.5528 0.148760
S3            -9.300      2.7723  -3.3546 0.006425 **
S4             0.000      0.0000
T1:S1          4.300      3.6875   1.1661 0.268238
T1:S2          5.750      4.7864   1.2013 0.254853
T1:S3          7.150      3.5025   2.0414 0.065946 .
```

```

T1:S4      0.000      0.0000
T2:S1      0.000      0.0000
T2:S2      0.000      0.0000
T2:S3      0.000      0.0000
T2:S4      0.000      0.0000
Z          0.850      0.6659  1.2765 0.228074
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 7.17 Example 11.2

(96) MODEL

```

ex11.2a = read.table("C:/G/Rt/Split/Ex11.2-sp3.txt", header=TRUE)
ex11.2a = af(ex11.2a, "A")
ex11.2a$MY = (ex11.2a$Y1 + ex11.2a$Y2)/sqrt(2)
ex11.2a$Z = 2*ex11.2a$Z/sqrt(2)
GLM(MY ~ Z + A, ex11.2a)

```

\$ANOVA

Response : MY

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	2	234.639	117.32	9.5696	0.01953 *
RESIDUALS	5	61.298	12.26		
CORRECTED TOTAL	7	295.937			

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Z	1	190.148	190.148	15.5101	0.01098 *
A	1	44.492	44.492	3.6291	0.11512

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Z	1	166.577	166.577	13.5874	0.0142 *
A	1	44.492	44.492	3.6291	0.1151

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Z	1	166.577	166.577	13.5874	0.0142 *
A	1	44.492	44.492	3.6291	0.1151

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
```

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	15.3934	2.70222	5.6966	0.002326 **
Z	1.0219	0.27724	3.6861	0.014203 *
A1	-4.7497	2.49325	-1.9050	0.115119
A2	0.0000	0.00000		

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
(97) MODEL
```

```
ex11.2b = read.table("C:/G/Rt/Split/Ex11.2-two.txt", header=TRUE)
ex11.2b = af(ex11.2b, c("sub", "A", "B"))
GLM(Y ~ A + A:sub + B + A:B, ex11.2b)
```

```
$ANOVA
```

```
Response : Y
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	9	382.06	42.451	39.954	0.0001135 ***
RESIDUALS	6	6.38	1.062		
CORRECTED TOTAL	15	388.44			

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	68.062	68.062	64.0588	0.0002029 ***
A:sub	6	227.875	37.979	35.7451	0.0001934 ***
B	1	85.562	85.562	80.5294	0.0001070 ***
A:B	1	0.562	0.562	0.5294	0.4942562

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	68.062	68.062	64.0588	0.0002029 ***
A:sub	6	227.875	37.979	35.7451	0.0001934 ***
B	1	85.562	85.562	80.5294	0.0001070 ***
A:B	1	0.562	0.562	0.5294	0.4942562

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
--	----	--------	---------	---------	--------

```

A      1  68.062  68.062 64.0588 0.0002029 ***
A:sub  6 227.875  37.979 35.7451 0.0001934 ***
B      1  85.562  85.562 80.5294 0.0001070 ***
A:B    1   0.562   0.562  0.5294 0.4942562
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept)  10.000     0.81490 12.2714 1.784e-05 ***
A1           -3.125     1.15244 -2.7116 0.0350301 *
A2            0.000     0.00000
A1:sub1       0.000     1.03078  0.0000 1.0000000
A1:sub2       4.500     1.03078  4.3656 0.0047414 **
A1:sub3       8.000     1.03078  7.7611 0.0002406 ***
A1:sub4       0.000     0.00000
A1:sub5       0.000     0.00000
A1:sub6       0.000     0.00000
A1:sub7       0.000     0.00000
A1:sub8       0.000     0.00000
A2:sub1       0.000     0.00000
A2:sub2       0.000     0.00000
A2:sub3       0.000     0.00000
A2:sub4       0.000     0.00000
A2:sub5       0.000     1.03078  0.0000 1.0000000
A2:sub6      10.000     1.03078  9.7014 6.883e-05 ***
A2:sub7       5.000     1.03078  4.8507 0.0028496 **
A2:sub8       0.000     0.00000
B1            5.000     0.72887  6.8599 0.0004725 ***
B2            0.000     0.00000
A1:B1       -0.750     1.03078 -0.7276 0.4942562
A1:B2        0.000     0.00000
A2:B1        0.000     0.00000
A2:B2        0.000     0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

(98) MODEL

```

ex11.2c = read.table("C:/G/Rt/Split/Ex11.2-spcov2.txt", header=TRUE)
ex11.2c = af(ex11.2c, c("block", "whole", "split"))
GLM(Y ~ block + whole + block:whole + split + split:whole, ex11.2c)

```

```

$ANOVA
Response : Y
      Df Sum Sq Mean Sq F value Pr(>F)
MODEL  11    328  29.8182   3.1948 0.02875 *

```

```
RESIDUALS      12      112  9.3333
CORRECTED TOTAL 23      440
```

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	48	24	2.5714	0.11765
whole	1	24	24	2.5714	0.13479
block:whole	2	16	8	0.8571	0.44880
split	3	156	52	5.5714	0.01251 *
whole:split	3	84	28	3.0000	0.07277 .

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	48	24	2.5714	0.11765
whole	1	24	24	2.5714	0.13479
block:whole	2	16	8	0.8571	0.44880
split	3	156	52	5.5714	0.01251 *
whole:split	3	84	28	3.0000	0.07277 .

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	48	24	2.5714	0.11765
whole	1	24	24	2.5714	0.13479
block:whole	2	16	8	0.8571	0.44880
split	3	156	52	5.5714	0.01251 *
whole:split	3	84	28	3.0000	0.07277 .

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
```

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	17	2.1602	7.8695	4.448e-06 ***
block1	-5	2.1602	-2.3146	0.0391521 *
block2	-1	2.1602	-0.4629	0.6517110
block3	0	0.0000		
whole1	-10	3.0551	-3.2733	0.0066627 **
whole2	0	0.0000		
block1:whole1	4	3.0551	1.3093	0.2149461
block1:whole2	0	0.0000		
block2:whole1	2	3.0551	0.6547	0.5250404
block2:whole2	0	0.0000		
block3:whole1	0	0.0000		

```

block3:whole2      0      0.0000
split1             -8      2.4944 -3.2071 0.0075321 **
split2             -9      2.4944 -3.6080 0.0035926 **
split3            -11      2.4944 -4.4098 0.0008506 ***
split4              0      0.0000
whole1:split1       6      3.5277  1.7008 0.1147185
whole1:split2      10      3.5277  2.8347 0.0150430 *
whole1:split3       8      3.5277  2.2678 0.0426079 *
whole1:split4       0      0.0000
whole2:split1       0      0.0000
whole2:split2       0      0.0000
whole2:split3       0      0.0000
whole2:split4       0      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

(99) MODEL

```
GLM(Z ~ block + whole + block:whole + split + split:whole, ex11.2c)
```

\$ANOVA

Response : Z

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	11	38	3.4545	3.5903e+15	< 2.2e-16 ***
RESIDUALS	12	0	0.0000		
CORRECTED TOTAL	23	38			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	36.000	18.0000	1.8707e+16	<2e-16 ***
whole	1	0.667	0.6667	6.9286e+14	<2e-16 ***
block:whole	2	1.333	0.6667	6.9286e+14	<2e-16 ***
split	3	0.000	0.0000	0.0000e+00	1
whole:split	3	0.000	0.0000	0.0000e+00	1

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	36.000	18.0000	1.8707e+16	<2e-16 ***
whole	1	0.667	0.6667	6.9286e+14	<2e-16 ***
block:whole	2	1.333	0.6667	6.9286e+14	<2e-16 ***
split	3	0.000	0.0000	0.0000e+00	1
whole:split	3	0.000	0.0000	0.0000e+00	1

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	36.000	18.0000	1.8707e+16	<2e-16 ***
whole	1	0.667	0.6667	6.9286e+14	<2e-16 ***
block:whole	2	1.333	0.6667	6.9286e+14	<2e-16 ***
split	3	0.000	0.0000	0.0000e+00	1
whole:split	3	0.000	0.0000	0.0000e+00	1

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	5	2.1934e-08	227957476	<2e-16 ***
block1	-3	2.1934e-08	-136774486	<2e-16 ***
block2	-1	2.1934e-08	-45591495	<2e-16 ***
block3	0	0.0000e+00		
whole1	0	3.1019e-08	0	1
whole2	0	0.0000e+00		
block1:whole1	0	3.1019e-08	0	1
block1:whole2	0	0.0000e+00		
block2:whole1	-1	3.1019e-08	-32238055	<2e-16 ***
block2:whole2	0	0.0000e+00		
block3:whole1	0	0.0000e+00		
block3:whole2	0	0.0000e+00		
split1	0	2.5327e-08	0	1
split2	0	2.5327e-08	0	1
split3	0	2.5327e-08	0	1
split4	0	0.0000e+00		
whole1:split1	0	3.5818e-08	0	1
whole1:split2	0	3.5818e-08	0	1
whole1:split3	0	3.5818e-08	0	1
whole1:split4	0	0.0000e+00		
whole2:split1	0	0.0000e+00		
whole2:split2	0	0.0000e+00		
whole2:split3	0	0.0000e+00		
whole2:split4	0	0.0000e+00		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

(100) MODEL

```
GLM(Y ~ block + whole + block:whole + split + split:whole + Z, ex11.2c)
```

\$ANOVA

Response : Y



	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	11	328	29.8182	3.1948	0.02875 *
RESIDUALS	12	112	9.3333		
CORRECTED TOTAL	23	440			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	48	24	2.5714	0.11765
whole	1	24	24	2.5714	0.13479
block:whole	2	16	8	0.8571	0.44880
split	3	156	52	5.5714	0.01251 *
whole:split	3	84	28	3.0000	0.07277 .
Z	0				

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	13.286	6.643	0.7117	0.51039
whole	1	16.000	16.000	1.7143	0.21495
block:whole	1	16.000	16.000	1.7143	0.21495
split	3	156.000	52.000	5.5714	0.01251 *
whole:split	3	84.000	28.000	3.0000	0.07277 .
Z	0				

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	13.286	6.643	0.7117	0.51039
whole	1	16.000	16.000	1.7143	0.21495
block:whole	1	16.000	16.000	1.7143	0.21495
split	3	156.000	52.000	5.5714	0.01251 *
whole:split	3	84.000	28.000	3.0000	0.07277 .
Z	0				

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	17	2.1602	7.8695	4.448e-06 ***
block1	-5	2.1602	-2.3146	0.0391521 *
block2	-1	2.1602	-0.4629	0.6517110
block3	0	0.0000		
whole1	-10	3.0551	-3.2733	0.0066627 **

```

whole2          0      0.0000
block1:whole1    4      3.0551  1.3093 0.2149461
block1:whole2    0      0.0000
block2:whole1    2      3.0551  0.6547 0.5250404
block2:whole2    0      0.0000
block3:whole1    0      0.0000
block3:whole2    0      0.0000
split1          -8      2.4944 -3.2071 0.0075321 **
split2          -9      2.4944 -3.6080 0.0035926 **
split3         -11      2.4944 -4.4098 0.0008506 ***
split4           0      0.0000
whole1:split1     6      3.5277  1.7008 0.1147185
whole1:split2    10      3.5277  2.8347 0.0150430 *
whole1:split3     8      3.5277  2.2678 0.0426079 *
whole1:split4     0      0.0000
whole2:split1     0      0.0000
whole2:split2     0      0.0000
whole2:split3     0      0.0000
whole2:split4     0      0.0000
Z                0      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 7.18 Example 11.3

(101) MODEL

```

ex11.3 = read.table("C:/G/Rt/Split/Ex11.3-sbcov.txt", header=TRUE)
ex11.3 = af(ex11.3, c("block", "A", "B"))
GLM(Y ~ block + A + block:A + B + block:B + A:B, ex11.3)

```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	17	16.833	0.9902	1.9804	0.2038
RESIDUALS	6	3.000	0.5000		
CORRECTED TOTAL	23	19.833			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	3	4.5000	1.5000	3.0000	0.11696
A	1	1.5000	1.5000	3.0000	0.13397
block:A	3	0.5000	0.1667	0.3333	0.80220
B	2	8.3333	4.1667	8.3333	0.01855 *
block:B	6	1.0000	0.1667	0.3333	0.89648
A:B	2	1.0000	0.5000	1.0000	0.42188

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	3	4.5000	1.5000	3.0000	0.11696
A	1	1.5000	1.5000	3.0000	0.13397
block:A	3	0.5000	0.1667	0.3333	0.80220
B	2	8.3333	4.1667	8.3333	0.01855 *
block:B	6	1.0000	0.1667	0.3333	0.89648
A:B	2	1.0000	0.5000	1.0000	0.42188

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	3	4.5000	1.5000	3.0000	0.11696
A	1	1.5000	1.5000	3.0000	0.13397
block:A	3	0.5000	0.1667	0.3333	0.80220
B	2	8.3333	4.1667	8.3333	0.01855 *
block:B	6	1.0000	0.1667	0.3333	0.89648
A:B	2	1.0000	0.5000	1.0000	0.42188

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	4.5000	0.61237	7.3485	0.000325 ***
block1	-1.3333	0.81650	-1.6330	0.153590
block2	-0.3333	0.81650	-0.4082	0.697261
block3	-0.3333	0.81650	-0.4082	0.697261
block4	0.0000	0.00000		
A1	-1.0000	0.70711	-1.4142	0.207031
A2	0.0000	0.00000		
block1:A1	0.6667	0.81650	0.8165	0.445416
block1:A2	0.0000	0.00000		
block2:A1	0.6667	0.81650	0.8165	0.445416
block2:A2	0.0000	0.00000		
block3:A1	0.6667	0.81650	0.8165	0.445416
block3:A2	0.0000	0.00000		
block4:A1	0.0000	0.00000		
block4:A2	0.0000	0.00000		
B1	-0.7500	0.79057	-0.9487	0.379410
B2	-1.7500	0.79057	-2.2136	0.068802 .
B3	0.0000	0.00000		
block1:B1	-0.5000	1.00000	-0.5000	0.634880
block1:B2	0.5000	1.00000	0.5000	0.634880
block1:B3	0.0000	0.00000		

```

block2:B1      -0.5000      1.00000 -0.5000 0.634880
block2:B2       0.5000      1.00000  0.5000 0.634880
block2:B3       0.0000      0.00000
block3:B1       0.0000      1.00000  0.0000 1.000000
block3:B2       0.0000      1.00000  0.0000 1.000000
block3:B3       0.0000      0.00000
block4:B1       0.0000      0.00000
block4:B2       0.0000      0.00000
block4:B3       0.0000      0.00000
A1:B1          -0.5000      0.70711 -0.7071 0.506021
A1:B2           0.5000      0.70711  0.7071 0.506021
A1:B3           0.0000      0.00000
A2:B1           0.0000      0.00000
A2:B2           0.0000      0.00000
A2:B3           0.0000      0.00000

```

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

(102) MODEL

```
GLM(Z ~ block + A + block:A + B + block:B + A:B, ex11.3)
```

\$ANOVA

Response : Z

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	17	31.167	1.83333	3.3	0.07324 .
RESIDUALS	6	3.333	0.55556		
CORRECTED TOTAL	23	34.500			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	3	6.8333	2.2778	4.1	0.06689 .
A	1	6.0000	6.0000	10.8	0.01669 *
block:A	3	1.6667	0.5556	1.0	0.45472
B	2	13.0000	6.5000	11.7	0.00850 **
block:B	6	3.6667	0.6111	1.1	0.45542
A:B	2	0.0000	0.0000	0.0	1.00000

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	3	6.8333	2.2778	4.1	0.06689 .
A	1	6.0000	6.0000	10.8	0.01669 *
block:A	3	1.6667	0.5556	1.0	0.45472

```

B          2 13.0000  6.5000    11.7 0.00850 **
block:B    6  3.6667  0.6111     1.1 0.45542
A:B        2  0.0000  0.0000     0.0 1.00000

```

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

```

      Df Sum Sq Mean Sq F value Pr(>F)
block   3  6.8333  2.2778     4.1 0.06689 .
A        1  6.0000  6.0000    10.8 0.01669 *
block:A  3  1.6667  0.5556     1.0 0.45472
B        2 13.0000  6.5000    11.7 0.00850 **
block:B  6  3.6667  0.6111     1.1 0.45542
A:B      2  0.0000  0.0000     0.0 1.00000

```

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

```

      Estimate Std. Error t value Pr(>|t|)
(Intercept)  2.83333    0.64550   4.3894 0.004621 **
block1        0.00000    0.86066   0.0000 1.000000
block2        1.83333    0.86066   2.1301 0.077194 .
block3       -0.16667    0.86066  -0.1936 0.852840
block4        0.00000    0.00000   0.0000 1.000000
A1           -1.66667    0.74536  -2.2361 0.066707 .
A2            0.00000    0.00000   0.0000 1.000000
block1:A1     1.00000    0.86066   1.1619 0.289403
block1:A2     0.00000    0.00000   0.0000 1.000000
block2:A1     0.33333    0.86066   0.3873 0.711901
block2:A2     0.00000    0.00000   0.0000 1.000000
block3:A1     1.33333    0.86066   1.5492 0.172308
block3:A2     0.00000    0.00000   0.0000 1.000000
block4:A1     0.00000    0.00000   0.0000 1.000000
block4:A2     0.00000    0.00000   0.0000 1.000000
B1           -0.50000    0.83333  -0.6000 0.570456
B2           -1.00000    0.83333  -1.2000 0.275367
B3            0.00000    0.00000   0.0000 1.000000
block1:B1    -2.00000    1.05409  -1.8974 0.106558
block1:B2     0.00000    1.05409   0.0000 1.000000
block1:B3     0.00000    0.00000   0.0000 1.000000
block2:B1    -2.00000    1.05409  -1.8974 0.106558
block2:B2    -0.50000    1.05409  -0.4743 0.652027
block2:B3     0.00000    0.00000   0.0000 1.000000
block3:B1    -1.00000    1.05409  -0.9487 0.379410
block3:B2    -0.50000    1.05409  -0.4743 0.652027
block3:B3     0.00000    0.00000   0.0000 1.000000
block4:B1     0.00000    0.00000   0.0000 1.000000
block4:B2     0.00000    0.00000   0.0000 1.000000

```

```

block4:B3      0.00000    0.00000
A1:B1          0.00000    0.74536    0.0000  1.000000
A1:B2          0.00000    0.74536    0.0000  1.000000
A1:B3          0.00000    0.00000
A2:B1          0.00000    0.00000
A2:B2          0.00000    0.00000
A2:B3          0.00000    0.00000

```

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

(103) MODEL

```
GLM(Y ~ block + A + block:A + B + block:B + A:B + Z, ex11.3)
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	18	17.8417	0.99120	2.4884	0.1589
RESIDUALS	5	1.9917	0.39833		
CORRECTED TOTAL	23	19.8333			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	3	4.5000	1.5000	3.7657	0.09378 .
A	1	1.5000	1.5000	3.7657	0.10999
block:A	3	0.5000	0.1667	0.4184	0.74788
B	2	8.3333	4.1667	10.4603	0.01634 *
block:B	6	1.0000	0.1667	0.4184	0.84059
A:B	2	1.0000	0.5000	1.2552	0.36163
Z	1	1.0083	1.0083	2.5314	0.17248

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	3	3.6203	1.20678	3.0296	0.1319
A	1	0.0000	0.00000	0.0000	1.0000
block:A	3	0.2583	0.08611	0.2162	0.8813
B	2	1.0317	0.51587	1.2951	0.3522
block:B	6	0.4210	0.07017	0.1762	0.9717
A:B	2	1.0000	0.50000	1.2552	0.3616
Z	1	1.0083	1.00833	2.5314	0.1725

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	3	3.6613	1.22045	3.0639	0.1297
A	1	0.0054	0.00536	0.0134	0.9122

```

block:A  3 0.2583 0.08611  0.2162 0.8813
B         2 0.7685 0.38427  0.9647 0.4423
block:B   6 0.4210 0.07017  0.1762 0.9717
A:B       2 1.0000 0.50000  1.2552 0.3616
Z         1 1.0083 1.00833  2.5314 0.1725

```

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	2.94167	1.12164	2.6227	0.04695 *
block1	-1.33333	0.72877	-1.8296	0.12684
block2	-1.34167	0.96580	-1.3892	0.22347
block3	-0.24167	0.73105	-0.3306	0.75437
block4	0.00000	0.00000		
A1	-0.08333	0.85456	-0.0975	0.92611
A2	0.00000	0.00000		
block1:A1	0.11667	0.80660	0.1446	0.89065
block1:A2	0.00000	0.00000		
block2:A1	0.48333	0.73783	0.6551	0.54135
block2:A2	0.00000	0.00000		
block3:A1	-0.06667	0.86230	-0.0773	0.94137
block3:A2	0.00000	0.00000		
block4:A1	0.00000	0.00000		
block4:A2	0.00000	0.00000		
B1	-0.47500	0.72649	-0.6538	0.54210
B2	-1.20000	0.78576	-1.5272	0.18725
B3	0.00000	0.00000		
block1:B1	0.60000	1.12901	0.5314	0.61787
block1:B2	0.50000	0.89256	0.5602	0.59952
block1:B3	0.00000	0.00000		
block2:B1	0.60000	1.12901	0.5314	0.61787
block2:B2	0.77500	0.90914	0.8525	0.43289
block2:B3	0.00000	0.00000		
block3:B1	0.55000	0.95717	0.5746	0.59044
block3:B2	0.27500	0.90914	0.3025	0.77446
block3:B3	0.00000	0.00000		
block4:B1	0.00000	0.00000		
block4:B2	0.00000	0.00000		
block4:B3	0.00000	0.00000		
A1:B1	-0.50000	0.63114	-0.7922	0.46414
A1:B2	0.50000	0.63114	0.7922	0.46414
A1:B3	0.00000	0.00000		
A2:B1	0.00000	0.00000		
A2:B2	0.00000	0.00000		
A2:B3	0.00000	0.00000		
Z	0.55000	0.34569	1.5910	0.17248

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 8 Hinkelmann & Kempthorne - Volume 1

### Reference

- Hinkelmann K, Kempthorne O. Design and Analysis of Experiments Volume 1 Introduction to Experimental Design. 2e. John Wiley & Sons Inc. 2008.

### 8.1 Chapter 6

#### 8.1.1 p202

(104) MODEL

```
v1p202 = read.table("C:/G/Rt/Kemp/v1p202.txt", head=TRUE)
v1p202 = af(v1p202,c("brand"))
GLM(miles ~ brand, v1p202) # OK
```

\$ANOVA

Response : miles

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	4	47.234	11.809	15.661	0.004924 **
RESIDUALS	5	3.770	0.754		
CORRECTED TOTAL	9	51.004			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
brand	4	47.234	11.809	15.661	0.004924 **

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
brand	4	47.234	11.809	15.661	0.004924 **

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
brand	4	47.234	11.809	15.661	0.004924 **

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
--	----------	------------	---------	----------



```

(Intercept)    25.90    0.61400 42.1822 1.413e-07 ***
brand1         -1.05    0.86833 -1.2092  0.28063
brand2          2.30    0.86833  2.6488  0.04549 *
brand3         -2.75    0.86833 -3.1670  0.02490 *
brand4          3.20    0.86833  3.6852  0.01422 *
brand5          0.00    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

### 8.1.2 p205

(105) MODEL

```

v1p205 = read.table("C:/G/Rt/Kemp/v1p205.txt", head=TRUE)
v1p205 = af(v1p205,c("brand", "car"))
GLM(miles ~ brand + car %in% brand, v1p205) # OK

```

\$ANOVA

Response : miles

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	9	140.05	15.561	80.21	1.017e-13 ***
RESIDUALS	20	3.88	0.194		
CORRECTED TOTAL	29	143.93			

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
brand	4	133.243	33.311	171.7053	3.553e-15 ***
brand:car	5	6.803	1.361	7.0137	0.0006214 ***

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
brand	4	133.243	33.311	171.7053	3.553e-15 ***
brand:car	5	6.803	1.361	7.0137	0.0006214 ***

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
brand	4	133.243	33.311	171.7053	3.553e-15 ***
brand:car	5	6.803	1.361	7.0137	0.0006214 ***

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$Parameter
      Estimate Std. Error  t value  Pr(>|t|)
(Intercept)  25.9000    0.25430 101.8496 < 2.2e-16 ***
brand1       -2.0333    0.35963  -5.6540 1.559e-05 ***
brand2        2.2333    0.35963   6.2101 4.580e-06 ***
brand3       -2.3667    0.35963  -6.5808 2.068e-06 ***
brand4        2.9333    0.35963   8.1565 8.629e-08 ***
brand5        0.0000    0.00000
brand1:car1   1.9333    0.35963   5.3759 2.915e-05 ***
brand1:car2   0.0000    0.00000
brand2:car1   0.1667    0.35963   0.4634  0.64805
brand2:car2   0.0000    0.00000
brand3:car1  -0.8667    0.35963  -2.4099  0.02571 *
brand3:car2   0.0000    0.00000
brand4:car1  -0.1333    0.35963  -0.3708  0.71472
brand4:car2   0.0000    0.00000
brand5:car1   0.0333    0.35963   0.0927  0.92707
brand5:car2   0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 8.2 Chapter 7

### 8.2.1 p232

(106) MODEL

```

v1p232 = read.table("C:/G/Rt/Kemp/v1p232.txt", head=TRUE)
v1p232 = af(v1p232,c("trt"))
GLM(yield ~ trt, v1p232) # OK

```

```

$ANOVA
Response : yield
      Df Sum Sq Mean Sq F value Pr(>F)
MODEL      4 59.174  14.793  28.781 0.0012 **
RESIDUALS   5  2.570   0.514
CORRECTED TOTAL 9 61.744
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
      Df Sum Sq Mean Sq F value Pr(>F)
trt    4 59.174  14.793  28.781 0.0012 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```
$`Type II`
      Df Sum Sq Mean Sq F value Pr(>F)
trt    4 59.174   14.793   28.781 0.0012 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
      Df Sum Sq Mean Sq F value Pr(>F)
trt    4 59.174   14.793   28.781 0.0012 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept)    13.35      0.50695 26.3339 1.476e-06 ***
trtA1           4.85      0.71694  6.7649 0.0010724 **
trtA2          -0.20      0.71694 -0.2790 0.7914426
trtB1           5.75      0.71694  8.0202 0.0004871 ***
trtB2           2.55      0.71694  3.5568 0.0162698 *
trtC            0.00      0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

## 8.2.2 p235

(107) MODEL

```
v1p235 = read.table("C:/G/Rt/Kemp/v1p235.txt", head=TRUE)
v1p235 = af(v1p235,c("density"))
GLM(yield ~ density, v1p235) # OK
```

```
$ANOVA
Response : yield
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      4 88.007  22.0017   32.198 1.095e-05 ***
RESIDUALS  10  6.833   0.6833
CORRECTED TOTAL 14 94.840
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
density  4 88.007  22.002   32.198 1.095e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
density  4 88.007  22.002  32.198 1.095e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
density  4 88.007  22.002  32.198 1.095e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept) 16.9667     0.47726 35.5501 7.362e-12 ***
density10   -4.9667     0.67495 -7.3586 2.429e-05 ***
density20   -0.9667     0.67495 -1.4322  0.1826
density30    2.0667     0.67495  3.0620  0.0120 *
density40    1.0333     0.67495  1.5310  0.1568
density50    0.0000     0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

## 8.3 Chapter 8

### 8.3.1 p265

(108) MODEL

```
v1p265 = read.table("C:/G/Rt/Kemp/v1p265.txt", head=TRUE)
v1p265 = af(v1p265,c("trt"))
GLM(y ~ trt + x, v1p265) # OK
```

```
$ANOVA
Response : y
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      3 84.678 28.2260  36.866 4.941e-06 ***
RESIDUALS  11  8.422  0.7656
CORRECTED TOTAL 14 93.100
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
trt    2 66.868  33.434  43.668 5.858e-06 ***
```

```

x      1 17.810  17.810  23.262 0.0005333 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
trt   2 83.147  41.573   54.299 1.996e-06 ***
x      1 17.810  17.810   23.262 0.0005333 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
trt   2 83.147  41.573   54.299 1.996e-06 ***
x      1 17.810  17.810   23.262 0.0005333 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept)   2.7154     0.81801  3.3196 0.0068363 **
trt1           6.2245     0.60214 10.3374 5.301e-07 ***
trt2           2.9315     0.56116  5.2239 0.0002838 ***
trt3           0.0000     0.00000
x              0.7733     0.16034  4.8230 0.0005333 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

### 8.3.2 p272

(109) MODEL

```
GLM(y ~ trt + x %in% trt, 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 t value Pr(>|t|)
(Intercept)   3.7395     1.25360   2.9830 0.015375 *
trt1           4.5929     1.73483   2.6475 0.026586 *
trt2           1.2883     1.85702   0.6937 0.505359
trt3           0.0000     0.00000
trt1:x         0.9759     0.37622   2.5938 0.029031 *
trt2:x         0.8957     0.25864   3.4630 0.007127 **
trt3:x         0.5448     0.26480   2.0572 0.069793 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

### 8.3.3 p273

(110) MODEL

```
GLM(y ~ trt + x + x %in% trt, v1p265) # OK
```

```

$ANOVA
Response : y
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      5 85.711   17.142  20.881 0.0001046 ***
RESIDUALS   9  7.389    0.821
CORRECTED TOTAL 14 93.100
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`

```

```

      Df Sum Sq Mean Sq F value    Pr(>F)
trt     2 66.868   33.434  40.7254 3.092e-05 ***
x       1 17.810   17.810  21.6940  0.001189 **
trt:x   2  1.033    0.517   0.6294  0.554843
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type II`

```

      Df Sum Sq Mean Sq F value    Pr(>F)
trt     2 83.147   41.573  50.6397 1.267e-05 ***
x       1 17.810   17.810  21.6940  0.001189 **
trt:x   2  1.033    0.517   0.6294  0.554843
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type III`

```

      Df Sum Sq Mean Sq F value    Pr(>F)
trt     2  6.1392   3.0696   3.7390 0.065769 .
x       1 17.2071  17.2071  20.9597 0.001331 **
trt:x   2  1.0334    0.5167   0.6294  0.554843
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$Parameter

```

      Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.7395     1.25360  2.9830  0.01537 *
trt1           4.5929     1.73483  2.6475  0.02659 *
trt2           1.2883     1.85702  0.6937  0.50536
trt3           0.0000     0.00000
x              0.5448     0.26480  2.0572  0.06979 .
trt1:x         0.4311     0.46007  0.9370  0.37320
trt2:x         0.3509     0.37016  0.9481  0.36785
trt3:x         0.0000     0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 8.4 Chapter 9

### 8.4.1 p344

(111) MODEL

```

v1p344 = read.table("C:/G/Rt/Kemp/v1p344.txt", head=TRUE)
v1p344 = af(v1p344,c("diet", "litter"))
GLM(gain ~ litter + diet, v1p344)

```

\$ANOVA

Response : gain

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	9	4915.6	546.18	15.544	3.363e-07 ***
RESIDUALS	20	702.8	35.14		
CORRECTED TOTAL	29	5618.4			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
litter	5	4438.0	887.6	25.2608	5.298e-08 ***
diet	4	477.6	119.4	3.3981	0.02824 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
litter	5	4438.0	887.6	25.2608	5.298e-08 ***
diet	4	477.6	119.4	3.3981	0.02824 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
litter	5	4438.0	887.6	25.2608	5.298e-08 ***
diet	4	477.6	119.4	3.3981	0.02824 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	54.357	3.4224	15.8828	8.344e-13 ***
litter1	19.940	3.7490	5.3187	3.318e-05 ***
litter2	17.100	3.7490	4.5612	0.0001897 ***
litter3	20.920	3.7490	5.5801	1.839e-05 ***
litter4	26.360	3.7490	7.0312	8.062e-07 ***
litter5	41.040	3.7490	10.9469	6.767e-10 ***
litter6	0.000	0.0000		
diet1	-12.367	3.4224	-3.6135	0.0017332 **
diet2	-7.650	3.4224	-2.2353	0.0369629 *
diet3	-8.100	3.4224	-2.3668	0.0281448 *
diet4	-6.567	3.4224	-1.9188	0.0694012 .
diet5	0.000	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1



## 8.4.2 p349

(112) MODEL

```
v1p349 = read.table("C:/G/Rt/Kemp/v1p349.txt", head=TRUE)
v1p349 = af(v1p349,c("subject", "exercise"))
GLM(diast ~ subject + exercise + subject:exercise, v1p349) # OK
```

\$ANOVA

Response : diast

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	14	1541.5	110.105	28.475	2.953e-08 ***
RESIDUALS	15	58.0	3.867		
CORRECTED TOTAL	29	1599.5			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
subject	4	905.13	226.283	58.5216	5.672e-09 ***
exercise	2	591.27	295.633	76.4569	1.357e-08 ***
subject:exercise	8	45.07	5.633	1.4569	0.2522

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
subject	4	905.13	226.283	58.5216	5.672e-09 ***
exercise	2	591.27	295.633	76.4569	1.357e-08 ***
subject:exercise	8	45.07	5.633	1.4569	0.2522

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
subject	4	905.13	226.283	58.5216	5.672e-09 ***
exercise	2	591.27	295.633	76.4569	1.357e-08 ***
subject:exercise	8	45.07	5.633	1.4569	0.2522

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	135.0	1.3904	97.0913	< 2.2e-16 ***
subject1	0.5	1.9664	0.2543	0.8027368
subject2	5.0	1.9664	2.5427	0.0225198 *
subject3	-5.5	1.9664	-2.7970	0.0135411 *

```

subject4          10.0      1.9664  5.0855 0.0001343 ***
subject5           0.0      0.0000
exercise1        -12.0      1.9664 -6.1026 2.023e-05 ***
exercise2          0.5      1.9664  0.2543 0.8027368
exercise3          0.0      0.0000
subject1:exercise1  4.0      2.7809  1.4384 0.1708608
subject1:exercise2  0.0      2.7809  0.0000 1.0000000
subject1:exercise3  0.0      0.0000
subject2:exercise1  8.0      2.7809  2.8768 0.0115245 *
subject2:exercise2  2.0      2.7809  0.7192 0.4830757
subject2:exercise3  0.0      0.0000
subject3:exercise1  2.0      2.7809  0.7192 0.4830757
subject3:exercise2  2.0      2.7809  0.7192 0.4830757
subject3:exercise3  0.0      0.0000
subject4:exercise1  2.5      2.7809  0.8990 0.3828608
subject4:exercise2  0.0      2.7809  0.0000 1.0000000
subject4:exercise3  0.0      0.0000
subject5:exercise1  0.0      0.0000
subject5:exercise2  0.0      0.0000
subject5:exercise3  0.0      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

### 8.4.3 p354

(113) MODEL

```

v1p354 = read.table("C:/G/Rt/Kemp/v1p354.txt", head=TRUE)
v1p354 = af(v1p354,c("loc", "block", "HSF"))
GLM(height ~ loc + block %in% loc + HSF + loc:HSF + block:loc:HSF, v1p354) # OK

```

\$ANOVA

Response : height

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	23	40782	1773.12	80.444	< 2.2e-16 ***
RESIDUALS	24	529	22.04		
CORRECTED TOTAL	47	41311			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
loc	1	20336.3	20336.3	922.6314	< 2.2e-16 ***
loc:block	6	1462.3	243.7	11.0573	6.408e-06 ***
HSF	2	12170.7	6085.3	276.0832	< 2.2e-16 ***
loc:HSF	2	6511.2	3255.6	147.7013	3.242e-14 ***

```
loc:block:HSF 12 301.2 25.1 1.1386 0.3769
---
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
loc	1	20336.3	20336.3	922.6314	< 2.2e-16 ***
loc:block	6	1462.3	243.7	11.0573	6.408e-06 ***
HSF	2	12170.7	6085.3	276.0832	< 2.2e-16 ***
loc:HSF	2	6511.2	3255.6	147.7013	3.242e-14 ***
loc:block:HSF	12	301.2	25.1	1.1386	0.3769

```
---
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
loc	1	20336.3	20336.3	922.6314	< 2.2e-16 ***
loc:block	6	1462.3	243.7	11.0573	6.408e-06 ***
HSF	2	12170.7	6085.3	276.0832	< 2.2e-16 ***
loc:HSF	2	6511.2	3255.6	147.7013	3.242e-14 ***
loc:block:HSF	12	301.2	25.1	1.1386	0.3769

```
---
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	191.0	3.3198	57.5342	< 2.2e-16 ***
loc1	22.5	4.6949	4.7925	7.039e-05 ***
loc2	0.0	0.0000		
loc1:block1	-20.0	4.6949	-4.2600	0.0002727 ***
loc1:block2	-8.0	4.6949	-1.7040	0.1012979
loc1:block3	-9.0	4.6949	-1.9170	0.0672189 .
loc1:block4	0.0	0.0000		
loc2:block1	-10.5	4.6949	-2.2365	0.0348764 *
loc2:block2	-4.5	4.6949	-0.9585	0.3473697
loc2:block3	10.0	4.6949	2.1300	0.0436248 *
loc2:block4	0.0	0.0000		
HSF1	-3.0	4.6949	-0.6390	0.5288766
HSF2	9.5	4.6949	2.0235	0.0542951 .
HSF3	0.0	0.0000		
loc1:HSF1	17.0	6.6395	2.5604	0.0171697 *
loc1:HSF2	53.5	6.6395	8.0578	2.778e-08 ***
loc1:HSF3	0.0	0.0000		
loc2:HSF1	0.0	0.0000		
loc2:HSF2	0.0	0.0000		
loc2:HSF3	0.0	0.0000		
loc1:block1:HSF1	8.0	6.6395	1.2049	0.2399873
loc1:block1:HSF2	-0.5	6.6395	-0.0753	0.9405950

```

loc1:block1:HSF3      0.0      0.0000
loc1:block2:HSF1     -1.5      6.6395 -0.2259 0.8231768
loc1:block2:HSF2     -0.5      6.6395 -0.0753 0.9405950
loc1:block2:HSF3      0.0      0.0000
loc1:block3:HSF1      4.0      6.6395  0.6025 0.5525233
loc1:block3:HSF2      6.5      6.6395  0.9790 0.3373533
loc1:block3:HSF3      0.0      0.0000
loc1:block4:HSF1      0.0      0.0000
loc1:block4:HSF2      0.0      0.0000
loc1:block4:HSF3      0.0      0.0000
loc2:block1:HSF1     -1.0      6.6395 -0.1506 0.8815396
loc2:block1:HSF2      2.0      6.6395  0.3012 0.7658364
loc2:block1:HSF3      0.0      0.0000
loc2:block2:HSF1     -1.5      6.6395 -0.2259 0.8231768
loc2:block2:HSF2      3.5      6.6395  0.5271 0.6029315
loc2:block2:HSF3      0.0      0.0000
loc2:block3:HSF1    -12.0      6.6395 -1.8074 0.0832589 .
loc2:block3:HSF2    -13.0      6.6395 -1.9580 0.0619570 .
loc2:block3:HSF3      0.0      0.0000
loc2:block4:HSF1      0.0      0.0000
loc2:block4:HSF2      0.0      0.0000
loc2:block4:HSF3      0.0      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

#### 8.4.4 p357

(114) MODEL

```

v1p357 = read.table("C:/G/Rt/Kemp/v1p357.txt", head=TRUE)
v1p357 = af(v1p357,c("var", "N"))
GLM(y ~ var + N + var:N, v1p357) # OK

```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	9	4465.5	496.16	14.116	0.000142 ***
RESIDUALS	10	351.5	35.15		
CORRECTED TOTAL	19	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 t value Pr(>|t|)
(Intercept)    134.0      4.1923 31.9637 2.114e-11 ***
var1             5.5      5.9287  0.9277 0.375420
var2             0.0      0.0000
N1              -17.5      5.9287 -2.9517 0.014492 *
N2               25.0      5.9287  4.2167 0.001781 **
N3               20.0      5.9287  3.3734 0.007081 **
N4                3.5      5.9287  0.5903 0.568060
N5                0.0      0.0000
var1:N1          -13.0      8.3845 -1.5505 0.152072
var1:N2          -32.5      8.3845 -3.8762 0.003078 **
var1:N3          -15.5      8.3845 -1.8486 0.094254 .
var1:N4           7.0      8.3845  0.8349 0.423286
var1:N5           0.0      0.0000
var2:N1           0.0      0.0000
var2:N2           0.0      0.0000
var2:N3           0.0      0.0000
var2:N4           0.0      0.0000
var2:N5           0.0      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

#### 8.4.5 p361

(115) MODEL

```
v1p361 = read.table("C:/G/Rt/Kemp/v1p361.txt", head=TRUE)
v1p361 = af(v1p361,c("block", "trt"))
GLM(y ~ block + trt, v1p361) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	4	241.33	60.333	40.222	0.1176
RESIDUALS	1	1.50	1.500		
CORRECTED TOTAL	5	242.83			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	24.333	12.167	8.1111	0.24097
trt	2	217.000	108.500	72.3333	0.08286 .

---  
Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	108	54.0	36.000	0.11704
trt	2	217	108.5	72.333	0.08286 .

---  
Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	2	108	54.0	36.000	0.11704
trt	2	217	108.5	72.333	0.08286 .

---  
Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	19.5	1.1180	17.4413	0.03646 *
block1	-12.0	1.4142	-8.4853	0.07468 .
block2	-6.0	1.4142	-4.2426	0.14736
block3	0.0	0.0000		
trt1	16.0	1.4142	11.3137	0.05612 .
trt2	3.0	1.4142	2.1213	0.28044
trt3	0.0	0.0000		

---  
Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

```
y = model.frame(y ~ block + trt, v1p361)[,1]
x = ModelMatrix(y ~ block + trt, v1p361)
```

```
rx = lfit(x, y)
K = cbind(rep(1, 3), matrix(1/3, nrow=3, ncol=3), diag(3)) ; K
```

```
      [,1]      [,2]      [,3]      [,4] [,5] [,6] [,7]
[1,]      1 0.3333333 0.3333333 0.3333333      1      0      0
[2,]      1 0.3333333 0.3333333 0.3333333      0      1      0
[3,]      1 0.3333333 0.3333333 0.3333333      0      0      1
```

```
est(K, rx)
```

```
      Estimate 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
```

## 8.5 Chapter 10

### 8.5.1 p405

(116) MODEL

```
v1p405 = read.table("C:/G/Rt/Kemp/v1p405.txt", head=TRUE)
v1p405 = af(v1p405,c("trt", "Row", "Col"))
GLM(y ~ Row + Col + trt, v1p405) # OK
```

\$ANOVA

Response : y

```
      Df Sum Sq Mean Sq F value Pr(>F)
MODEL      12 4094.7   341.23   2.3416 0.07739 .
RESIDUALS    12 1748.7   145.73
CORRECTED TOTAL 24 5843.4
```

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

```
      Df Sum Sq Mean Sq F value Pr(>F)
Row  4   514.24   128.56   0.8822 0.50328
Col  4  1711.44   427.86   2.9360 0.06611 .
trt  4  1869.04   467.26   3.2064 0.05229 .
```

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

```
      Df Sum Sq Mean Sq F value Pr(>F)
```

```

Row 4 514.24 128.56 0.8822 0.50328
Col 4 1711.44 427.86 2.9360 0.06611 .
trt 4 1869.04 467.26 3.2064 0.05229 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type III`
      Df Sum Sq Mean Sq F value Pr(>F)
Row 4 514.24 128.56 0.8822 0.50328
Col 4 1711.44 427.86 2.9360 0.06611 .
trt 4 1869.04 467.26 3.2064 0.05229 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept)  102.16      8.7050 11.7357 6.195e-08 ***
Row1          12.00      7.6348  1.5717 0.141991
Row2           4.00      7.6348  0.5239 0.609878
Row3           6.00      7.6348  0.7859 0.447183
Row4          -0.40      7.6348 -0.0524 0.959079
Row5           0.00      0.0000
Col1           5.80      7.6348  0.7597 0.462112
Col2          -6.60      7.6348 -0.8645 0.404285
Col3         -18.80      7.6348 -2.4624 0.029907 *
Col4          -1.80      7.6348 -0.2358 0.817593
Col5           0.00      0.0000
trt1         -25.00      7.6348 -3.2745 0.006648 **
trt2          -3.20      7.6348 -0.4191 0.682525
trt3          -7.20      7.6348 -0.9430 0.364257
trt4          -9.00      7.6348 -1.1788 0.261321
trt5           0.00      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 8.5.2 p408

(117) MODEL

```

vip408 = read.table("C:/G/Rt/Kemp/vip408.txt", head=TRUE)
vip408 = af(vip408,c("breed", "farm", "wclass", "dosage"))
GLM(response ~ breed + breed:farm + wclass + dosage + breed:dosage, vip408) # OK

```

```

$ANOVA
Response : response
      Df Sum Sq Mean Sq F value Pr(>F)

```



```

MODEL          16 4470.2 279.391 140.87 2.039e-13 ***
RESIDUALS      15  29.7   1.983
CORRECTED TOTAL 31 4500.0

```

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
breed	1	3280.5	3280.5	1654.0336	< 2.2e-16 ***
breed:farm	6	9.0	1.5	0.7563	0.6146
wclass	3	466.8	155.6	78.4454	2.142e-09 ***
dosage	3	580.2	193.4	97.5210	4.596e-10 ***
breed:dosage	3	133.8	44.6	22.4790	8.366e-06 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
breed	1	3280.5	3280.5	1654.0336	< 2.2e-16 ***
breed:farm	6	9.0	1.5	0.7563	0.6146
wclass	3	466.7	155.6	78.4454	2.142e-09 ***
dosage	3	580.2	193.4	97.5210	4.596e-10 ***
breed:dosage	3	133.8	44.6	22.4790	8.366e-06 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
breed	1	3280.5	3280.5	1654.0336	< 2.2e-16 ***
breed:farm	6	9.0	1.5	0.7563	0.6146
wclass	3	466.8	155.6	78.4454	2.142e-09 ***
dosage	3	580.3	193.4	97.5210	4.596e-10 ***
breed:dosage	3	133.7	44.6	22.4790	8.366e-06 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	168.500	1.02647	164.1544	< 2.2e-16 ***
breed1	-19.750	1.31735	-14.9922	1.956e-10 ***
breed2	0.000	0.00000		
breed1:farm1	0.500	0.99582	0.5021	0.6228896
breed1:farm2	-0.500	0.99582	-0.5021	0.6228896
breed1:farm3	0.500	0.99582	0.5021	0.6228896
breed1:farm4	0.000	0.00000		
breed2:farm1	-0.750	0.99582	-0.7531	0.4630208
breed2:farm2	-1.750	0.99582	-1.7573	0.0992451 .
breed2:farm3	-1.000	0.99582	-1.0042	0.3312109

```

breed2:farm4      0.000    0.00000
wclass1          -10.375    0.70415 -14.7340 2.498e-10 ***
wclass2           -6.000    0.70415  -8.5209 3.927e-07 ***
wclass3           -3.125    0.70415  -4.4379 0.0004791 ***
wclass4            0.000    0.00000
dosageC           -1.000    0.99582  -1.0042 0.3312109
dosageH            14.000    0.99582  14.0587 4.829e-10 ***
dosageL           -0.500    0.99582  -0.5021 0.6228896
dosageM            0.000    0.00000
breed1:dosageC     1.750    1.40831   1.2426 0.2330815
breed1:dosageH    -8.500    1.40831  -6.0356 2.281e-05 ***
breed1:dosageL     0.750    1.40831   0.5326 0.6021431
breed1:dosageM     0.000    0.00000
breed2:dosageC     0.000    0.00000
breed2:dosageH     0.000    0.00000
breed2:dosageL     0.000    0.00000
breed2:dosageM     0.000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

### 8.5.3 p410

(118) MODEL

```

v1p410 = read.table("C:/G/Rt/Kemp/v1p410.txt", head=TRUE)
v1p410$carry = ifelse(v1p410$carry == 0, 3, v1p410$carry)
v1p410 = af(v1p410, c("period", "sequence", "steer", "trt", "carry"))
GLM(y ~ period + sequence + steer:sequence + trt + carry, v1p410) # OK

```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	17	1302.51	76.618	8.7402	1.572e-05 ***
RESIDUALS	18	157.79	8.766		
CORRECTED TOTAL	35	1460.31			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
period	2	292.06	146.028	16.6580	8.038e-05 ***
sequence	5	326.47	65.294	7.4484	0.0006072 ***
sequence:steer	6	118.50	19.750	2.2530	0.0849122 .
trt	2	549.06	274.528	31.3166	1.377e-06 ***
carry	2	16.43	8.215	0.9372	0.4100385

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
period	2	172.31	86.154	9.8279	0.0013030 **
sequence	5	318.69	63.738	7.2709	0.0006954 ***
sequence:steer	6	118.50	19.750	2.2530	0.0849122 .
trt	2	440.61	220.304	25.1311	6.164e-06 ***
carry	2	16.43	8.215	0.9372	0.4100385

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
period	2	172.31	86.154	9.8279	0.0013030 **
sequence	5	318.69	63.738	7.2709	0.0006954 ***
sequence:steer	6	118.50	19.750	2.2530	0.0849122 .
trt	2	440.61	220.304	25.1311	6.164e-06 ***
carry	2	16.43	8.215	0.9372	0.4100385

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	52.854	2.3407	22.5805	1.177e-14 ***
period1	-6.604	1.5990	-4.1302	0.0006286 ***
period2	-0.083	1.2087	-0.0689	0.9457953
period3	0.000	0.0000		
sequence1	3.208	2.4919	1.2875	0.2142212
sequence2	-3.000	2.4175	-1.2410	0.2305478
sequence3	-6.771	2.4919	-2.7172	0.0141265 *
sequence4	-1.438	2.4919	-0.5769	0.5711674
sequence5	1.208	2.4919	0.4849	0.6335881
sequence6	0.000	0.0000		
sequence1:steer1	-3.667	2.4175	-1.5167	0.1466983
sequence1:steer2	0.000	0.0000		
sequence1:steer3	0.000	0.0000		
sequence1:steer4	0.000	0.0000		
sequence1:steer5	0.000	0.0000		
sequence1:steer6	0.000	0.0000		
sequence1:steer7	0.000	0.0000		
sequence1:steer8	0.000	0.0000		
sequence1:steer9	0.000	0.0000		
sequence1:steer10	0.000	0.0000		
sequence1:steer11	0.000	0.0000		
sequence1:steer12	0.000	0.0000		
sequence2:steer1	0.000	0.0000		
sequence2:steer2	0.000	0.0000		

sequence2:steer3	-4.333	2.4175	-1.7925	0.0898747	.
sequence2:steer4	0.000	0.0000			
sequence2:steer5	0.000	0.0000			
sequence2:steer6	0.000	0.0000			
sequence2:steer7	0.000	0.0000			
sequence2:steer8	0.000	0.0000			
sequence2:steer9	0.000	0.0000			
sequence2:steer10	0.000	0.0000			
sequence2:steer11	0.000	0.0000			
sequence2:steer12	0.000	0.0000			
sequence3:steer1	0.000	0.0000			
sequence3:steer2	0.000	0.0000			
sequence3:steer3	0.000	0.0000			
sequence3:steer4	0.000	0.0000			
sequence3:steer5	-3.333	2.4175	-1.3789	0.1848347	
sequence3:steer6	0.000	0.0000			
sequence3:steer7	0.000	0.0000			
sequence3:steer8	0.000	0.0000			
sequence3:steer9	0.000	0.0000			
sequence3:steer10	0.000	0.0000			
sequence3:steer11	0.000	0.0000			
sequence3:steer12	0.000	0.0000			
sequence4:steer1	0.000	0.0000			
sequence4:steer2	0.000	0.0000			
sequence4:steer3	0.000	0.0000			
sequence4:steer4	0.000	0.0000			
sequence4:steer5	0.000	0.0000			
sequence4:steer6	0.000	0.0000			
sequence4:steer7	-3.333	2.4175	-1.3789	0.1848347	
sequence4:steer8	0.000	0.0000			
sequence4:steer9	0.000	0.0000			
sequence4:steer10	0.000	0.0000			
sequence4:steer11	0.000	0.0000			
sequence4:steer12	0.000	0.0000			
sequence5:steer1	0.000	0.0000			
sequence5:steer2	0.000	0.0000			
sequence5:steer3	0.000	0.0000			
sequence5:steer4	0.000	0.0000			
sequence5:steer5	0.000	0.0000			
sequence5:steer6	0.000	0.0000			
sequence5:steer7	0.000	0.0000			
sequence5:steer8	0.000	0.0000			
sequence5:steer9	-3.667	2.4175	-1.5167	0.1466983	
sequence5:steer10	0.000	0.0000			
sequence5:steer11	0.000	0.0000			
sequence5:steer12	0.000	0.0000			
sequence6:steer1	0.000	0.0000			
sequence6:steer2	0.000	0.0000			

```

sequence6:steer3      0.000      0.0000
sequence6:steer4      0.000      0.0000
sequence6:steer5      0.000      0.0000
sequence6:steer6      0.000      0.0000
sequence6:steer7      0.000      0.0000
sequence6:steer8      0.000      0.0000
sequence6:steer9      0.000      0.0000
sequence6:steer10     0.000      0.0000
sequence6:steer11    -3.333      2.4175 -1.3789 0.1848347
sequence6:steer12     0.000      0.0000
trt1                   9.542      1.3514  7.0606 1.384e-06 ***
trt2                   5.521      1.3514  4.0853 0.0006946 ***
trt3                   0.000      0.0000
carry1                 0.375      1.8131  0.2068 0.8384657
carry2                -1.938      1.8131 -1.0686 0.2993665
carry3                 0.000      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

options(contrasts=c("contr.sum", "contr.poly"))
Anova(lm(y ~ period + sequence + steer:sequence + trt + carry, v1p410), type=3,
      singular.ok=TRUE) # NOT OK for sequence

```

Note: model has aliased coefficients  
 sums of squares computed by model comparison

Anova Table (Type III tests)

```

Response: y
      Sum Sq Df F values    Pr(>F)
period    172.31  2   9.8279 0.001303 **
sequence     0.00  0
trt        440.61  2  25.1311 6.164e-06 ***
carry       16.43  2   0.9372 0.410038
sequence:steer 118.50  6   2.2530 0.084912 .
Residuals   157.79 18
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 8.6 Chapter 11

### 8.6.1 p432

(119) MODEL

```
v1p432 = read.table("C:/G/Rt/Kemp/v1p432.txt", head=TRUE)
v1p432 = af(v1p432,c("V", "Block", "A", "B", "C"))
GLM(Y ~ V + Block:V + A + B + A:B + V:A + V:B + V:A:B + Block:A:V + Block:B:V,
     v1p432) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	94	261663	2783.65	30.584	2.065e-14 ***
RESIDUALS	25	2275	91.02		
CORRECTED TOTAL	119	263939			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	102743	25686	282.2094	< 2.2e-16 ***
V:Block	25	50019	2001	21.9825	1.588e-11 ***
A	1	18451	18451	202.7233	1.692e-13 ***
B	1	78541	78541	862.9280	< 2.2e-16 ***
A:B	1	108	108	1.1899	0.28575
V:A	4	3751	938	10.3023	4.532e-05 ***
V:B	4	307	77	0.8421	0.51168
V:A:B	4	1495	374	4.1058	0.01081 *
V:Block:A	25	3416	137	1.5011	0.15818
V:Block:B	25	2833	113	1.2451	0.29390

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	102743	25686	282.2094	< 2.2e-16 ***
V:Block	25	50019	2001	21.9825	1.588e-11 ***
A	1	18451	18451	202.7233	1.692e-13 ***
B	1	78541	78541	862.9280	< 2.2e-16 ***
A:B	1	108	108	1.1899	0.28575
V:A	4	3751	938	10.3023	4.532e-05 ***
V:B	4	307	77	0.8421	0.51168
V:A:B	4	1495	374	4.1058	0.01081 *
V:Block:A	25	3416	137	1.5011	0.15818
V:Block:B	25	2833	113	1.2451	0.29390

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	102743	25686	282.2094	< 2.2e-16 ***

V:Block	25	50019	2001	21.9825	1.588e-11	***
A	1	18451	18451	202.7233	1.692e-13	***
B	1	78541	78541	862.9280	< 2.2e-16	***
A:B	1	108	108	1.1899	0.28575	
V:A	4	3751	938	10.3023	4.532e-05	***
V:B	4	307	77	0.8421	0.51168	
V:A:B	4	1495	374	4.1058	0.01081	*
V:Block:A	25	3416	137	1.5011	0.15818	
V:Block:B	25	2833	113	1.2451	0.29390	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	727.67	8.4885	85.7237	< 2.2e-16 ***
VAm	-89.00	12.0046	-7.4138	9.141e-08 ***
VCo	-30.58	12.0046	-2.5476	0.0173738 *
VFe	-36.62	12.0046	-3.0509	0.0053411 **
VHa	-53.37	12.0046	-4.4462	0.0001566 ***
VPi	0.00	0.0000		
VAm:Block1	-65.00	11.6844	-5.5630	8.751e-06 ***
VAm:Block2	-70.75	11.6844	-6.0551	2.512e-06 ***
VAm:Block3	-38.50	11.6844	-3.2950	0.0029414 **
VAm:Block4	-43.25	11.6844	-3.7015	0.0010618 **
VAm:Block5	-21.50	11.6844	-1.8401	0.0776619 .
VAm:Block6	0.00	0.0000		
VCo:Block1	-54.25	11.6844	-4.6429	9.401e-05 ***
VCo:Block2	-50.75	11.6844	-4.3434	0.0002043 ***
VCo:Block3	-54.75	11.6844	-4.6857	8.414e-05 ***
VCo:Block4	-34.25	11.6844	-2.9313	0.0071180 **
VCo:Block5	-31.50	11.6844	-2.6959	0.0123750 *
VCo:Block6	0.00	0.0000		
VFe:Block1	-48.00	11.6844	-4.1080	0.0003752 ***
VFe:Block2	-46.75	11.6844	-4.0011	0.0004941 ***
VFe:Block3	-43.25	11.6844	-3.7015	0.0010618 **
VFe:Block4	-31.25	11.6844	-2.6745	0.0130019 *
VFe:Block5	-10.00	11.6844	-0.8558	0.4002135
VFe:Block6	0.00	0.0000		
VHa:Block1	-57.00	11.6844	-4.8783	5.108e-05 ***
VHa:Block2	-74.50	11.6844	-6.3760	1.127e-06 ***
VHa:Block3	-57.50	11.6844	-4.9211	4.572e-05 ***
VHa:Block4	-41.25	11.6844	-3.5304	0.0016360 **
VHa:Block5	-15.50	11.6844	-1.3266	0.1966467
VHa:Block6	0.00	0.0000		
VPi:Block1	-31.00	11.6844	-2.6531	0.0136586 *
VPi:Block2	-55.25	11.6844	-4.7285	7.530e-05 ***
VPi:Block3	-57.75	11.6844	-4.9425	4.325e-05 ***
VPi:Block4	-37.00	11.6844	-3.1666	0.0040322 **

VPi:Block5	-4.00	11.6844	-0.3423	0.7349587	
VPi:Block6	0.00	0.0000			
AF	-14.33	10.3047	-1.3910	0.1764960	
AM	0.00	0.0000			
BH	-52.33	10.3047	-5.0786	3.042e-05	***
BL	0.00	0.0000			
AF:BH	-5.33	7.7896	-0.6847	0.4998485	
AF:BL	0.00	0.0000			
AM:BH	0.00	0.0000			
AM:BL	0.00	0.0000			
VAm:AF	34.00	14.5730	2.3331	0.0279872	*
VAm:AM	0.00	0.0000			
VCo:AF	-29.83	14.5730	-2.0472	0.0512888	.
VCo:AM	0.00	0.0000			
VFe:AF	-26.75	14.5730	-1.8356	0.0783425	.
VFe:AM	0.00	0.0000			
VHa:AF	-21.25	14.5730	-1.4582	0.1572413	
VHa:AM	0.00	0.0000			
VPi:AF	0.00	0.0000			
VPi:AM	0.00	0.0000			
VAm:BH	-5.00	14.5730	-0.3431	0.7343914	
VAm:BL	0.00	0.0000			
VCo:BH	-4.83	14.5730	-0.3317	0.7429077	
VCo:BL	0.00	0.0000			
VFe:BH	19.25	14.5730	1.3209	0.1984868	
VFe:BL	0.00	0.0000			
VHa:BH	-17.25	14.5730	-1.1837	0.2476668	
VHa:BL	0.00	0.0000			
VPi:BH	0.00	0.0000			
VPi:BL	0.00	0.0000			
VAm:AF:BH	-15.00	11.0161	-1.3616	0.1854582	
VAm:AF:BL	0.00	0.0000			
VAm:AM:BH	0.00	0.0000			
VAm:AM:BL	0.00	0.0000			
VCo:AF:BH	19.67	11.0161	1.7853	0.0863588	.
VCo:AF:BL	0.00	0.0000			
VCo:AM:BH	0.00	0.0000			
VCo:AM:BL	0.00	0.0000			
VFe:AF:BH	-12.50	11.0161	-1.1347	0.2672649	
VFe:AF:BL	0.00	0.0000			
VFe:AM:BH	0.00	0.0000			
VFe:AM:BL	0.00	0.0000			
VHa:AF:BH	15.50	11.0161	1.4070	0.1717311	
VHa:AF:BL	0.00	0.0000			
VHa:AM:BH	0.00	0.0000			
VHa:AM:BL	0.00	0.0000			
VPi:AF:BH	0.00	0.0000			
VPi:AF:BL	0.00	0.0000			



VPi:AM:BH	0.00	0.0000		
VPi:AM:BL	0.00	0.0000		
VAm:Block1:AF	-14.00	13.4920	-1.0377	0.3093639
VAm:Block1:AM	0.00	0.0000		
VAm:Block2:AF	-14.50	13.4920	-1.0747	0.2927668
VAm:Block2:AM	0.00	0.0000		
VAm:Block3:AF	-26.00	13.4920	-1.9271	0.0654087 .
VAm:Block3:AM	0.00	0.0000		
VAm:Block4:AF	-19.50	13.4920	-1.4453	0.1607920
VAm:Block4:AM	0.00	0.0000		
VAm:Block5:AF	0.00	13.4920	0.0000	1.0000000
VAm:Block5:AM	0.00	0.0000		
VAm:Block6:AF	0.00	0.0000		
VAm:Block6:AM	0.00	0.0000		
VCo:Block1:AF	6.50	13.4920	0.4818	0.6341615
VCo:Block1:AM	0.00	0.0000		
VCo:Block2:AF	-10.50	13.4920	-0.7782	0.4437309
VCo:Block2:AM	0.00	0.0000		
VCo:Block3:AF	1.50	13.4920	0.1112	0.9123636
VCo:Block3:AM	0.00	0.0000		
VCo:Block4:AF	-2.50	13.4920	-0.1853	0.8544925
VCo:Block4:AM	0.00	0.0000		
VCo:Block5:AF	21.00	13.4920	1.5565	0.1321638
VCo:Block5:AM	0.00	0.0000		
VCo:Block6:AF	0.00	0.0000		
VCo:Block6:AM	0.00	0.0000		
VFe:Block1:AF	20.00	13.4920	1.4824	0.1507406
VFe:Block1:AM	0.00	0.0000		
VFe:Block2:AF	20.50	13.4920	1.5194	0.1412033
VFe:Block2:AM	0.00	0.0000		
VFe:Block3:AF	36.50	13.4920	2.7053	0.0121084 *
VFe:Block3:AM	0.00	0.0000		
VFe:Block4:AF	30.50	13.4920	2.2606	0.0327423 *
VFe:Block4:AM	0.00	0.0000		
VFe:Block5:AF	17.00	13.4920	1.2600	0.2193017
VFe:Block5:AM	0.00	0.0000		
VFe:Block6:AF	0.00	0.0000		
VFe:Block6:AM	0.00	0.0000		
VHa:Block1:AF	2.00	13.4920	0.1482	0.8833455
VHa:Block1:AM	0.00	0.0000		
VHa:Block2:AF	16.00	13.4920	1.1859	0.2468148
VHa:Block2:AM	0.00	0.0000		
VHa:Block3:AF	19.00	13.4920	1.4082	0.1713737
VHa:Block3:AM	0.00	0.0000		
VHa:Block4:AF	-0.50	13.4920	-0.0371	0.9707322
VHa:Block4:AM	0.00	0.0000		
VHa:Block5:AF	-27.00	13.4920	-2.0012	0.0563396 .
VHa:Block5:AM	0.00	0.0000		

VHa:Block6:AF	0.00	0.0000		
VHa:Block6:AM	0.00	0.0000		
VPi:Block1:AF	-16.00	13.4920	-1.1859	0.2468148
VPi:Block1:AM	0.00	0.0000		
VPi:Block2:AF	-14.50	13.4920	-1.0747	0.2927668
VPi:Block2:AM	0.00	0.0000		
VPi:Block3:AF	-12.50	13.4920	-0.9265	0.3630565
VPi:Block3:AM	0.00	0.0000		
VPi:Block4:AF	-11.00	13.4920	-0.8153	0.4226006
VPi:Block4:AM	0.00	0.0000		
VPi:Block5:AF	-16.00	13.4920	-1.1859	0.2468148
VPi:Block5:AM	0.00	0.0000		
VPi:Block6:AF	0.00	0.0000		
VPi:Block6:AM	0.00	0.0000		
VAm:Block1:BH	30.00	13.4920	2.2235	0.0354473 *
VAm:Block1:BL	0.00	0.0000		
VAm:Block2:BH	24.50	13.4920	1.8159	0.0813993 .
VAm:Block2:BL	0.00	0.0000		
VAm:Block3:BH	4.00	13.4920	0.2965	0.7693182
VAm:Block3:BL	0.00	0.0000		
VAm:Block4:BH	6.50	13.4920	0.4818	0.6341615
VAm:Block4:BL	0.00	0.0000		
VAm:Block5:BH	1.00	13.4920	0.0741	0.9415063
VAm:Block5:BL	0.00	0.0000		
VAm:Block6:BH	0.00	0.0000		
VAm:Block6:BL	0.00	0.0000		
VCo:Block1:BH	-12.50	13.4920	-0.9265	0.3630565
VCo:Block1:BL	0.00	0.0000		
VCo:Block2:BH	-4.50	13.4920	-0.3335	0.7415143
VCo:Block2:BL	0.00	0.0000		
VCo:Block3:BH	1.50	13.4920	0.1112	0.9123636
VCo:Block3:BL	0.00	0.0000		
VCo:Block4:BH	-6.50	13.4920	-0.4818	0.6341615
VCo:Block4:BL	0.00	0.0000		
VCo:Block5:BH	4.00	13.4920	0.2965	0.7693182
VCo:Block5:BL	0.00	0.0000		
VCo:Block6:BH	0.00	0.0000		
VCo:Block6:BL	0.00	0.0000		
VFe:Block1:BH	-8.00	13.4920	-0.5929	0.5585441
VFe:Block1:BL	0.00	0.0000		
VFe:Block2:BH	-12.50	13.4920	-0.9265	0.3630565
VFe:Block2:BL	0.00	0.0000		
VFe:Block3:BH	-11.50	13.4920	-0.8524	0.4021071
VFe:Block3:BL	0.00	0.0000		
VFe:Block4:BH	0.50	13.4920	0.0371	0.9707322
VFe:Block4:BL	0.00	0.0000		
VFe:Block5:BH	-2.00	13.4920	-0.1482	0.8833455
VFe:Block5:BL	0.00	0.0000		

```

VFe:Block6:BH      0.00      0.0000
VFe:Block6:BL      0.00      0.0000
VHa:Block1:BH      8.00     13.4920  0.5929 0.5585441
VHa:Block1:BL      0.00      0.0000
VHa:Block2:BH     15.00     13.4920  1.1118 0.2768138
VHa:Block2:BL      0.00      0.0000
VHa:Block3:BH     21.00     13.4920  1.5565 0.1321638
VHa:Block3:BL      0.00      0.0000
VHa:Block4:BH     33.50     13.4920  2.4830 0.0200965 *
VHa:Block4:BL      0.00      0.0000
VHa:Block5:BH     14.00     13.4920  1.0377 0.3093639
VHa:Block5:BL      0.00      0.0000
VHa:Block6:BH      0.00      0.0000
VHa:Block6:BL      0.00      0.0000
VPi:Block1:BH    -14.00     13.4920 -1.0377 0.3093639
VPi:Block1:BL      0.00      0.0000
VPi:Block2:BH     17.50     13.4920  1.2971 0.2064513
VPi:Block2:BL      0.00      0.0000
VPi:Block3:BH     24.50     13.4920  1.8159 0.0813993 .
VPi:Block3:BL      0.00      0.0000
VPi:Block4:BH      8.00     13.4920  0.5929 0.5585441
VPi:Block4:BL      0.00      0.0000
VPi:Block5:BH     -3.00     13.4920 -0.2224 0.8258445
VPi:Block5:BL      0.00      0.0000
VPi:Block6:BH      0.00      0.0000
VPi:Block6:BL      0.00      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 8.6.2 p434

(120) MODEL

```
GLM(Y ~ V + Block:V + A + B + A:B + V:A + V:B + V:A:B, v1p432) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	44	255415	5804.9	51.075	< 2.2e-16 ***
RESIDUALS	75	8524	113.7		
CORRECTED TOTAL	119	263939			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
--	----	--------	---------	---------	--------

V	4	102743	25686	225.9988	< 2.2e-16	***
V:Block	25	50019	2001	17.6040	< 2.2e-16	***
A	1	18451	18451	162.3447	< 2.2e-16	***
B	1	78541	78541	691.0494	< 2.2e-16	***
A:B	1	108	108	0.9529	0.33212	
V:A	4	3751	938	8.2503	1.435e-05	***
V:B	4	307	77	0.6744	0.61182	
V:A:B	4	1495	374	3.2880	0.01541	*

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	102743	25686	225.9988	< 2.2e-16 ***
V:Block	25	50019	2001	17.6040	< 2.2e-16 ***
A	1	18451	18451	162.3447	< 2.2e-16 ***
B	1	78541	78541	691.0494	< 2.2e-16 ***
A:B	1	108	108	0.9529	0.33212
V:A	4	3751	938	8.2503	1.435e-05 ***
V:B	4	307	77	0.6744	0.61182
V:A:B	4	1495	374	3.2880	0.01541 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	102743	25686	225.9988	< 2.2e-16 ***
V:Block	25	50019	2001	17.6040	< 2.2e-16 ***
A	1	18451	18451	162.3447	< 2.2e-16 ***
B	1	78541	78541	691.0494	< 2.2e-16 ***
A:B	1	108	108	0.9529	0.33212
V:A	4	3751	938	8.2503	1.435e-05 ***
V:B	4	307	77	0.6744	0.61182
V:A:B	4	1495	374	3.2880	0.01541 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	730.75	6.5284	111.9335	< 2.2e-16 ***
VAm	-91.42	9.2326	-9.9015	2.887e-15 ***
VCo	-33.50	9.2326	-3.6284	0.0005179 ***
VFe	-47.29	9.2326	-5.1223	2.269e-06 ***
VHa	-64.87	9.2326	-7.0267	8.274e-10 ***
VPi	0.00	0.0000		
VAm:Block1	-57.00	7.5384	-7.5613	8.123e-11 ***
VAm:Block2	-65.75	7.5384	-8.7220	5.032e-13 ***
VAm:Block3	-49.50	7.5384	-6.5664	5.963e-09 ***

VAm:Block4	-49.75	7.5384	-6.5996	5.177e-09	***
VAm:Block5	-21.00	7.5384	-2.7857	0.0067590	**
VAm:Block6	0.00	0.0000			
VCo:Block1	-57.25	7.5384	-7.5945	7.029e-11	***
VCo:Block2	-58.25	7.5384	-7.7271	3.938e-11	***
VCo:Block3	-53.25	7.5384	-7.0638	7.048e-10	***
VCo:Block4	-38.75	7.5384	-5.1404	2.113e-06	***
VCo:Block5	-19.00	7.5384	-2.5204	0.0138466	*
VCo:Block6	0.00	0.0000			
VFe:Block1	-42.00	7.5384	-5.5715	3.771e-07	***
VFe:Block2	-42.75	7.5384	-5.6710	2.515e-07	***
VFe:Block3	-30.75	7.5384	-4.0791	0.0001116	***
VFe:Block4	-15.75	7.5384	-2.0893	0.0400719	*
VFe:Block5	-2.50	7.5384	-0.3316	0.7410890	
VFe:Block6	0.00	0.0000			
VHa:Block1	-52.00	7.5384	-6.8980	1.441e-09	***
VHa:Block2	-59.00	7.5384	-7.8266	2.549e-11	***
VHa:Block3	-37.50	7.5384	-4.9745	4.038e-06	***
VHa:Block4	-24.75	7.5384	-3.2832	0.0015606	**
VHa:Block5	-22.00	7.5384	-2.9184	0.0046415	**
VHa:Block6	0.00	0.0000			
VPi:Block1	-46.00	7.5384	-6.1021	4.234e-08	***
VPi:Block2	-53.75	7.5384	-7.1302	5.290e-10	***
VPi:Block3	-51.75	7.5384	-6.8649	1.662e-09	***
VPi:Block4	-38.50	7.5384	-5.1072	2.407e-06	***
VPi:Block5	-13.50	7.5384	-1.7908	0.0773547	.
VPi:Block6	0.00	0.0000			
AF	-26.00	6.1551	-4.2242	6.669e-05	***
AM	0.00	0.0000			
BH	-46.83	6.1551	-7.6089	6.600e-11	***
BL	0.00	0.0000			
AF:BH	-5.33	8.7046	-0.6127	0.5419251	
AF:BL	0.00	0.0000			
AM:BH	0.00	0.0000			
AM:BL	0.00	0.0000			
VAm:AF	33.33	8.7046	3.8294	0.0002645	***
VAm:AM	0.00	0.0000			
VCo:AF	-15.50	8.7046	-1.7807	0.0790155	.
VCo:AM	0.00	0.0000			
VFe:AF	5.67	8.7046	0.6510	0.5170370	
VFe:AM	0.00	0.0000			
VHa:AF	-8.00	8.7046	-0.9191	0.3610122	
VHa:AM	0.00	0.0000			
VPi:AF	0.00	0.0000			
VPi:AM	0.00	0.0000			
VAm:BH	0.50	8.7046	0.0574	0.9543466	
VAm:BL	0.00	0.0000			
VCo:BH	-13.33	8.7046	-1.5318	0.1297887	

VCo:BL	0.00	0.0000		
VFe:BH	8.17	8.7046	0.9382	0.3511512
VFe:BL	0.00	0.0000		
VHa:BH	-7.50	8.7046	-0.8616	0.3916454
VHa:BL	0.00	0.0000		
VPi:BH	0.00	0.0000		
VPi:BL	0.00	0.0000		
VAm:AF:BH	-15.00	12.3101	-1.2185	0.2268497
VAm:AF:BL	0.00	0.0000		
VAm:AM:BH	0.00	0.0000		
VAm:AM:BL	0.00	0.0000		
VCo:AF:BH	19.67	12.3101	1.5976	0.1143369
VCo:AF:BL	0.00	0.0000		
VCo:AM:BH	0.00	0.0000		
VCo:AM:BL	0.00	0.0000		
VFe:AF:BH	-12.50	12.3101	-1.0154	0.3131683
VFe:AF:BL	0.00	0.0000		
VFe:AM:BH	0.00	0.0000		
VFe:AM:BL	0.00	0.0000		
VHa:AF:BH	15.50	12.3101	1.2591	0.2118897
VHa:AF:BL	0.00	0.0000		
VHa:AM:BH	0.00	0.0000		
VHa:AM:BL	0.00	0.0000		
VPi:AF:BH	0.00	0.0000		
VPi:AF:BL	0.00	0.0000		
VPi:AM:BH	0.00	0.0000		
VPi:AM:BL	0.00	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

### 8.6.3 p438

(121) MODEL

```
GLM(Y ~ V + Block:V + C + V:C, v1p432) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	44	255415	5804.9	51.075	< 2.2e-16 ***
RESIDUALS	75	8524	113.7		
CORRECTED TOTAL	119	263939			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	102743	25686	225.9988	< 2.2e-16 ***
V:Block	25	50019	2001	17.6040	< 2.2e-16 ***
C	3	97100	32367	284.7823	< 2.2e-16 ***
V:C	12	5552	463	4.0709	7.23e-05 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	102743	25686	225.9988	< 2.2e-16 ***
V:Block	25	50019	2001	17.6040	< 2.2e-16 ***
C	3	97100	32367	284.7823	< 2.2e-16 ***
V:C	12	5552	463	4.0709	7.23e-05 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	102743	25686	225.9988	< 2.2e-16 ***
V:Block	25	50019	2001	17.6040	< 2.2e-16 ***
C	3	97100	32367	284.7823	< 2.2e-16 ***
V:C	12	5552	463	4.0709	7.23e-05 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	730.75	6.5284	111.9335	< 2.2e-16 ***
VAm	-91.42	9.2326	-9.9015	2.887e-15 ***
VCo	-33.50	9.2326	-3.6284	0.0005179 ***
VFe	-47.29	9.2326	-5.1223	2.269e-06 ***
VHa	-64.87	9.2326	-7.0267	8.274e-10 ***
VPi	0.00	0.0000		
VAm:Block1	-57.00	7.5384	-7.5613	8.123e-11 ***
VAm:Block2	-65.75	7.5384	-8.7220	5.032e-13 ***
VAm:Block3	-49.50	7.5384	-6.5664	5.963e-09 ***
VAm:Block4	-49.75	7.5384	-6.5996	5.177e-09 ***
VAm:Block5	-21.00	7.5384	-2.7857	0.0067590 **
VAm:Block6	0.00	0.0000		
VCo:Block1	-57.25	7.5384	-7.5945	7.029e-11 ***
VCo:Block2	-58.25	7.5384	-7.7271	3.938e-11 ***
VCo:Block3	-53.25	7.5384	-7.0638	7.048e-10 ***
VCo:Block4	-38.75	7.5384	-5.1404	2.113e-06 ***
VCo:Block5	-19.00	7.5384	-2.5204	0.0138466 *
VCo:Block6	0.00	0.0000		
VFe:Block1	-42.00	7.5384	-5.5715	3.771e-07 ***
VFe:Block2	-42.75	7.5384	-5.6710	2.515e-07 ***

VFe:Block3	-30.75	7.5384	-4.0791	0.0001116	***
VFe:Block4	-15.75	7.5384	-2.0893	0.0400719	*
VFe:Block5	-2.50	7.5384	-0.3316	0.7410890	
VFe:Block6	0.00	0.0000			
VHa:Block1	-52.00	7.5384	-6.8980	1.441e-09	***
VHa:Block2	-59.00	7.5384	-7.8266	2.549e-11	***
VHa:Block3	-37.50	7.5384	-4.9745	4.038e-06	***
VHa:Block4	-24.75	7.5384	-3.2832	0.0015606	**
VHa:Block5	-22.00	7.5384	-2.9184	0.0046415	**
VHa:Block6	0.00	0.0000			
VPi:Block1	-46.00	7.5384	-6.1021	4.234e-08	***
VPi:Block2	-53.75	7.5384	-7.1302	5.290e-10	***
VPi:Block3	-51.75	7.5384	-6.8649	1.662e-09	***
VPi:Block4	-38.50	7.5384	-5.1072	2.407e-06	***
VPi:Block5	-13.50	7.5384	-1.7908	0.0773547	.
VPi:Block6	0.00	0.0000			
C1	-78.17	6.1551	-12.6996	< 2.2e-16	***
C2	-26.00	6.1551	-4.2242	6.669e-05	***
C3	-46.83	6.1551	-7.6089	6.600e-11	***
C4	0.00	0.0000			
VAm:C1	18.83	8.7046	2.1636	0.0336791	*
VAm:C2	33.33	8.7046	3.8294	0.0002645	***
VAm:C3	0.50	8.7046	0.0574	0.9543466	
VAm:C4	0.00	0.0000			
VCo:C1	-9.17	8.7046	-1.0531	0.2956825	
VCo:C2	-15.50	8.7046	-1.7807	0.0790155	.
VCo:C3	-13.33	8.7046	-1.5318	0.1297887	
VCo:C4	0.00	0.0000			
VFe:C1	1.33	8.7046	0.1532	0.8786707	
VFe:C2	5.67	8.7046	0.6510	0.5170370	
VFe:C3	8.17	8.7046	0.9382	0.3511512	
VFe:C4	0.00	0.0000			
VHa:C1	0.00	8.7046	0.0000	1.0000000	
VHa:C2	-8.00	8.7046	-0.9191	0.3610122	
VHa:C3	-7.50	8.7046	-0.8616	0.3916454	
VHa:C4	0.00	0.0000			
VPi:C1	0.00	0.0000			
VPi:C2	0.00	0.0000			
VPi:C3	0.00	0.0000			
VPi:C4	0.00	0.0000			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

#### 8.6.4 p444

(122) MODEL



```
v1p444 = v1p432[v1p432$Block==5,]
GLM(Y ~ V + A + B + A:B + V:A, v1p444) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	11	39278	3570.8	59.787	1.897e-06 ***
RESIDUALS	8	478	59.7		
CORRECTED TOTAL	19	39756			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	19287.7	4821.9	80.7355	1.674e-06 ***
A	1	3380.0	3380.0	56.5927	6.780e-05 ***
B	1	14045.0	14045.0	235.1612	3.247e-07 ***
A:B	1	115.2	115.2	1.9288	0.202326
V:A	4	2450.5	612.6	10.2574	0.003081 **

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	19287.7	4821.9	80.7355	1.674e-06 ***
A	1	3380.0	3380.0	56.5927	6.780e-05 ***
B	1	14045.0	14045.0	235.1612	3.247e-07 ***
A:B	1	115.2	115.2	1.9288	0.202326
V:A	4	2450.5	612.6	10.2574	0.003081 **

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
V	4	19287.7	4821.9	80.7355	1.674e-06 ***
A	1	3380.0	3380.0	56.5927	6.780e-05 ***
B	1	14045.0	14045.0	235.1612	3.247e-07 ***
A:B	1	115.2	115.2	1.9288	0.202326
V:A	4	2450.5	612.6	10.2574	0.003081 **

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	720.1	5.9862	120.2927	2.554e-14 ***
VAm	-107.0	7.7282	-13.8454	7.159e-07 ***
VCo	-57.0	7.7282	-7.3756	7.800e-05 ***

VFe	-32.5	7.7282	-4.2054	0.002975	**
VHa	-65.0	7.7282	-8.4108	3.040e-05	***
VPi	0.0	0.0000			
AF	-28.2	8.4658	-3.3310	0.010368	*
AM	0.0	0.0000			
BH	-48.2	4.8877	-9.8614	9.419e-06	***
BL	0.0	0.0000			
AF:BH	-9.6	6.9123	-1.3888	0.202326	
AF:BL	0.0	0.0000			
AM:BH	0.0	0.0000			
AM:BL	0.0	0.0000			
VAm:AF	42.5	10.9293	3.8886	0.004618	**
VAm:AM	0.0	0.0000			
VCo:AF	17.0	10.9293	1.5554	0.158449	
VCo:AM	0.0	0.0000			
VFe:AF	0.0	10.9293	0.0000	1.000000	
VFe:AM	0.0	0.0000			
VHa:AF	-24.5	10.9293	-2.2417	0.055281	.
VHa:AM	0.0	0.0000			
VPi:AF	0.0	0.0000			
VPi:AM	0.0	0.0000			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

### 8.6.5 p482

(123) MODEL

```
v1p482 = read.table("C:/G/Rt/Kemp/v1p482.txt", head=TRUE)
v1p482 = af(v1p482,c("block", "A", "B"))
GLM(y ~ block + A + B + A:B, v1p482) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	8	156.88	19.6094	9.8871	9.377e-05 ***
RESIDUALS	15	29.75	1.9833		
CORRECTED TOTAL	23	186.62			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	5	108.38	21.675	10.9286	0.0001415 ***
A	1	4.00	4.000	2.0168	0.1760166
B	1	42.25	42.250	21.3025	0.0003365 ***

```

A:B      1    2.25    2.250  1.1345 0.3036727
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
block  5 31.417   6.283   3.1681 0.0377804 *
A       1  4.000   4.000   2.0168 0.1760166
B       1 42.250  42.250  21.3025 0.0003365 ***
A:B     1  2.250   2.250   1.1345 0.3036727
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
block  5 31.417   6.283   3.1681 0.0377804 *
A       1  4.000   4.000   2.0168 0.1760166
B       1 42.250  42.250  21.3025 0.0003365 ***
A:B     1  2.250   2.250   1.1345 0.3036727
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept)    9.000     0.86241 10.4359 2.842e-08 ***
block1         -1.375     1.11337 -1.2350  0.23583
block2          1.125     1.11337  1.0104  0.32830
block3         -0.125     1.11337 -0.1123  0.91210
block4          2.875     1.11337  2.5823  0.02082 *
block5          1.250     1.21963  1.0249  0.32166
block6          0.000     0.00000
A0             -0.250     0.99582 -0.2510  0.80518
A1              0.000     0.00000
B0             -2.500     0.99582 -2.5105  0.02400 *
B1              0.000     0.00000
A0:B0          -1.500     1.40831 -1.0651  0.30367
A0:B1           0.000     0.00000
A1:B0           0.000     0.00000
A1:B1           0.000     0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 8.7 Chapter 12

### 8.7.1 p525

(124) MODEL

```
v1p525 = read.table("C:/G/Rt/Kemp/v1p525.txt", head=TRUE)
REG(y ~ x1 + x2 + x3, v1p525)
```

```

              Estimate Std. Error  t value Pr(>|t|)
(Intercept)  14.2125     0.10383  136.8787 < 2.2e-16 ***
x1            0.7875     0.10383   7.5843 6.465e-06 ***
x2            1.3875     0.10383  13.3628 1.446e-08 ***
x3            1.6625     0.10383  16.0113 1.839e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
GLM(y ~ x1 + x2 + x3, v1p525) # OK
```

```
$ANOVA
```

```
Response : y
```

```

              Df Sum Sq Mean Sq F value    Pr(>F)
MODEL           3  84.948  28.3158   164.15 5.26e-10 ***
RESIDUALS       12   2.070   0.1725
CORRECTED TOTAL 15  87.018
---
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  t value Pr(>|t|)
(Intercept)  14.2125     0.10383 136.8787 < 2.2e-16 ***
x1           0.7875     0.10383   7.5843 6.465e-06 ***
x2           1.3875     0.10383  13.3628 1.446e-08 ***
x3           1.6625     0.10383  16.0113 1.839e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

## 8.7.2 p527

(125) MODEL

```
v1p527 = read.table("C:/G/Rt/Kemp/v1p527.txt", head=TRUE)
GLM(y ~ A + B, v1p527) # OK
```

```
$ANOVA
Response : y
      Df Sum Sq Mean Sq F value Pr(>F)
MODEL      2  22.99  11.4952   4.8917 0.04686 *
RESIDUALS   7   16.45   2.3499
CORRECTED TOTAL 9  39.44
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
      Df Sum Sq Mean Sq F value Pr(>F)
A  1 10.364   10.364   4.4103 0.07386 .
B  1 12.626   12.626   5.3730 0.05355 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
      Df Sum Sq Mean Sq F value Pr(>F)
A  1 10.364   10.364   4.4103 0.07386 .
B  1 12.626   12.626   5.3730 0.05355 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
      Df Sum Sq Mean Sq F value Pr(>F)
A  1 10.364   10.364   4.4103 0.07386 .
B  1 12.626   12.626   5.3730 0.05355 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```

$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept)   5.2000     0.48476 10.7269 1.345e-05 ***
A              1.1439     0.54471  2.1001  0.07386 .
B              1.2626     0.54471  2.3180  0.05355 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

### 8.7.3 p529

(126) MODEL

```

v1p529 = read.table("C:/G/Rt/Kemp/v1p529.txt", head=TRUE)
GLM(y ~ A + B + I(A*A) + I(B*B) + I(A*B), v1p529) # OK

```

```

$ANOVA
Response : y
      Df Sum Sq Mean Sq F value Pr(>F)
MODEL      5 35.713   7.1427  6.7928 0.01857 *
RESIDUALS   6  6.309   1.0515
CORRECTED TOTAL 11 42.023
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type I`
      Df Sum Sq Mean Sq F value Pr(>F)
A          1 11.6012 11.6012 11.0329 0.01597 *
B          1 12.6263 12.6263 12.0077 0.01338 *
I(A * A)    1  1.7167  1.7167  1.6326 0.24855
I(B * B)    1  5.3593  5.3593  5.0967 0.06476 .
I(A * B)    1  4.4100  4.4100  4.1940 0.08649 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type II`
      Df Sum Sq Mean Sq F value Pr(>F)
A          1 11.6012 11.6012 11.0329 0.01597 *
B          1 12.6263 12.6263 12.0077 0.01338 *
I(A * A)    1  5.5468  5.5468  5.2750 0.06137 .
I(B * B)    1  5.3593  5.3593  5.0967 0.06476 .
I(A * B)    1  4.4100  4.4100  4.1940 0.08649 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type III`
      Df Sum Sq Mean Sq F value Pr(>F)

```

```

A          1 11.6012 11.6012 11.0329 0.01597 *
B          1 12.6263 12.6263 12.0077 0.01338 *
I(A * A)   1  5.5468  5.5468  5.2750 0.06137 .
I(B * B)   1  5.3593  5.3593  5.0967 0.06476 .
I(A * B)   1  4.4100  4.4100  4.1940 0.08649 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept)   3.5625     0.72492  4.9144 0.002672 **
A              0.9899     0.29801  3.3216 0.015973 *
B              1.2626     0.36437  3.4652 0.013382 *
I(A * A)       1.0106     0.44003  2.2967 0.061374 .
I(B * B)       1.0838     0.48007  2.2576 0.064762 .
I(A * B)       1.0500     0.51272  2.0479 0.086491 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 8.8 Chapter 13

### 8.8.1 p563

(127) MODEL

```

v1p563 = read.table("C:/G/Rt/Kemp/v1p563.txt", head=TRUE)
v1p563 = af(v1p563, c("rep", "A", "B"))
GLM(y ~ rep + A + rep:A + B + A:B, v1p563) # OK

```

```

$ANOVA
Response : y
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      14 2097.08 149.792   17.228 8.385e-05 ***
RESIDUALS     9   78.25   8.694
CORRECTED TOTAL 23 2175.33
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
rep      3 1241.00  413.67  47.5783 7.606e-06 ***
A         2  353.08  176.54  20.3051 0.0004613 ***
rep:A     6  192.25   32.04   3.6853 0.0393557 *
B         1  216.00  216.00  24.8435 0.0007550 ***
A:B       2   94.75   47.38   5.4489 0.0281496 *
---

```

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
rep	3	1241.00	413.67	47.5783	7.606e-06	***
A	2	353.08	176.54	20.3051	0.0004613	***
rep:A	6	192.25	32.04	3.6853	0.0393557	*
B	1	216.00	216.00	24.8435	0.0007550	***
A:B	2	94.75	47.38	5.4489	0.0281496	*

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
rep	3	1241.00	413.67	47.5783	7.606e-06	***
A	2	353.08	176.54	20.3051	0.0004613	***
rep:A	6	192.25	32.04	3.6853	0.0393557	*
B	1	216.00	216.00	24.8435	0.0007550	***
A:B	2	94.75	47.38	5.4489	0.0281496	*

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	17.250	2.3311	7.3999	4.104e-05	***
rep1	19.500	2.9486	6.6132	9.778e-05	***
rep2	14.000	2.9486	4.7480	0.001047	**
rep3	-0.500	2.9486	-0.1696	0.869099	
rep4	0.000	0.0000			
A1	5.375	3.2967	1.6304	0.137448	
A2	11.375	3.2967	3.4504	0.007270	**
A3	0.000	0.0000			
rep1:A1	1.500	4.1700	0.3597	0.727358	
rep1:A2	-9.000	4.1700	-2.1583	0.059234	.
rep1:A3	0.000	0.0000			
rep2:A1	-11.000	4.1700	-2.6379	0.027007	*
rep2:A2	-14.500	4.1700	-3.4772	0.006969	**
rep2:A3	0.000	0.0000			
rep3:A1	1.000	4.1700	0.2398	0.815851	
rep3:A2	-3.000	4.1700	-0.7194	0.490137	
rep3:A3	0.000	0.0000			
rep4:A1	0.000	0.0000			
rep4:A2	0.000	0.0000			
rep4:A3	0.000	0.0000			
B1	0.500	2.0850	0.2398	0.815851	
B2	0.000	0.0000			
A1:B1	9.250	2.9486	3.1370	0.011985	*
A1:B2	0.000	0.0000			



```

A2:B1          7.250      2.9486  2.4588  0.036232 *
A2:B2          0.000      0.0000
A3:B1          0.000      0.0000
A3:B2          0.000      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

### 8.8.2 p566

(128) MODEL

```

v1p566 = read.table("C:/G/Rt/Kemp/v1p566.txt", head=TRUE)
v1p566 = af(v1p566, c("subject", "A", "B"))
GLM(y ~ A + B + A:B, v1p566) # OK

```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	5	1469.58	293.92	86.2	5.592e-09 ***
RESIDUALS	12	40.92	3.41		
CORRECTED TOTAL	17	1510.50			

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	2	1390.04	695.02	203.8350	5.466e-10 ***
B	1	76.06	76.06	22.3055	0.0004945 ***
A:B	2	3.49	1.74	0.5112	0.6122667

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	2	1390.04	695.02	203.8350	5.466e-10 ***
B	1	76.06	76.06	22.3055	0.0004945 ***
A:B	2	3.49	1.74	0.5112	0.6122667

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	2	1390.04	695.02	203.8350	5.466e-10 ***
B	1	79.00	79.00	23.1700	0.0004237 ***
A:B	2	3.49	1.74	0.5112	0.6122667

```

---

```

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	54.500	1.3057	41.7400	2.309e-14 ***
A1	-23.750	1.5992	-14.8516	4.354e-09 ***
A2	-18.167	1.6857	-10.7772	1.586e-07 ***
A3	0.000	0.0000		
B1	-5.500	1.8465	-2.9785	0.01152 *
B2	0.000	0.0000		
A1:B1	2.250	2.2615	0.9949	0.33943
A1:B2	0.000	0.0000		
A2:B1	1.167	2.3839	0.4894	0.63338
A2:B2	0.000	0.0000		
A3:B1	0.000	0.0000		
A3:B2	0.000	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 8.9 Chapter 14

### 8.9.1 p581

(129) MODEL

```
v1p581 = read.table("C:/G/Rt/Kemp/v1p581.txt", head=TRUE)
v1p581 = af(v1p581, c("drug", "person", "time"))
GLM(rate ~ drug + person:drug + time + drug:time, v1p581) # OK
```

\$ANOVA

Response : rate

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	23	2449.5	106.500	12.733	3.469e-11 ***
RESIDUALS	36	301.1	8.364		
CORRECTED TOTAL	59	2750.6			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
drug	2	337.60	168.800	20.1820	1.323e-06 ***
drug:person	12	1498.50	124.875	14.9303	1.501e-10 ***
time	3	256.33	85.444	10.2159	5.230e-05 ***
drug:time	6	357.07	59.511	7.1152	4.707e-05 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
drug	2	337.60	168.800	20.1820	1.323e-06 ***
drug:person	12	1498.50	124.875	14.9303	1.501e-10 ***
time	3	256.33	85.444	10.2159	5.230e-05 ***
drug:time	6	357.07	59.511	7.1152	4.707e-05 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
drug	2	337.60	168.800	20.1820	1.323e-06 ***
drug:person	12	1498.50	124.875	14.9303	1.501e-10 ***
time	3	256.33	85.444	10.2159	5.230e-05 ***
drug:time	6	357.07	59.511	7.1152	4.707e-05 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	71.05	1.8291	38.8445	< 2.2e-16 ***
drug1	-2.95	2.5867	-1.1404	0.261633
drug2	8.20	2.5867	3.1700	0.003108 **
drug3	0.00	0.0000		
drug1:person1	7.00	2.0450	3.4230	0.001559 **
drug1:person2	10.50	2.0450	5.1345	9.954e-06 ***
drug1:person3	5.25	2.0450	2.5673	0.014551 *
drug1:person4	4.75	2.0450	2.3228	0.025959 *
drug1:person5	0.00	0.0000		
drug2:person1	2.75	2.0450	1.3448	0.187116
drug2:person2	2.25	2.0450	1.1003	0.278524
drug2:person3	-7.25	2.0450	-3.5453	0.001109 **
drug2:person4	2.00	2.0450	0.9780	0.334599
drug2:person5	0.00	0.0000		
drug3:person1	1.25	2.0450	0.6113	0.544873
drug3:person2	-3.75	2.0450	-1.8338	0.074968 .
drug3:person3	16.50	2.0450	8.0685	1.374e-09 ***
drug3:person4	6.75	2.0450	3.3008	0.002182 **
drug3:person5	0.00	0.0000		
time1	-1.00	1.8291	-0.5467	0.587943
time2	0.40	1.8291	0.2187	0.828128
time3	-0.60	1.8291	-0.3280	0.744787
time4	0.00	0.0000		
drug1:time1	-0.80	2.5867	-0.3093	0.758897
drug1:time2	8.60	2.5867	3.3247	0.002044 **
drug1:time3	9.00	2.5867	3.4793	0.001334 **
drug1:time4	0.00	0.0000		

drug2:time1	3.20	2.5867	1.2371	0.224063
drug2:time2	5.00	2.5867	1.9330	0.061138 .
drug2:time3	-1.00	2.5867	-0.3866	0.701335
drug2:time4	0.00	0.0000		
drug3:time1	0.00	0.0000		
drug3:time2	0.00	0.0000		
drug3:time3	0.00	0.0000		
drug3:time4	0.00	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 9 Hinkelmann & Kempthorne - Volume 2

*Reference* - Hinkelmann K, Kempthorne O. Design and Analysis of Experiments Volume 2 Advanced Experimental Design. 2e. John Wiley & Sons Inc. 2008.

### 9.1 Chapter 1

#### 9.1.1 p53

(130) MODEL

```
v2p53 = read.table("C:/G/Rt/Kemp/v2p53.txt", head=TRUE)
v2p53 = af(v2p53, c("TRT", "BLOCK"))
GLM(Y ~ BLOCK + TRT, v2p53) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	7	518.21	74.030	8.1408	0.1137
RESIDUALS	2	18.19	9.094		
CORRECTED TOTAL	9	536.40			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
BLOCK	4	261.40	65.350	7.1863	0.12587
TRT	3	256.81	85.604	9.4135	0.09755 .

---  
Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
BLOCK	4	79.146	19.786	2.1758	0.33880
TRT	3	256.812	85.604	9.4135	0.09755 .

---  
Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
BLOCK	4	79.146	19.786	2.1758	0.33880
TRT	3	256.813	85.604	9.4135	0.09755 .

---  
Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	31.1250	2.6116	11.9181	0.006967 **

```

BLOCK1      -7.6875      3.4548 -2.2252 0.156028
BLOCK2      -4.0625      3.4548 -1.1759 0.360652
BLOCK3      -1.9375      3.4548 -0.5608 0.631370
BLOCK4      -9.3125      3.4548 -2.6955 0.114475
BLOCK5       0.0000      0.0000
TRT1        -15.2500     3.0156 -5.0571 0.036949 *
TRT2         -9.6250     3.3715 -2.8548 0.103924
TRT3         -3.1250     3.3715 -0.9269 0.451839
TRT4          0.0000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

### 9.1.2 p62

(131) MODEL

```
GLM(Y ~ TRT + BLOCK, v2p53) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	7	518.21	74.030	8.1408	0.1137
RESIDUALS	2	18.19	9.094		
CORRECTED TOTAL	9	536.40			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TRT	3	439.07	146.356	16.0941	0.05907 .
BLOCK	4	79.15	19.786	2.1758	0.33880

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TRT	3	256.812	85.604	9.4135	0.09755 .
BLOCK	4	79.146	19.786	2.1758	0.33880

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
TRT	3	256.813	85.604	9.4135	0.09755 .
BLOCK	4	79.146	19.786	2.1758	0.33880

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept)  31.1250     2.6116  11.9181 0.006967 **
TRT1         -15.2500     3.0156  -5.0571 0.036949 *
TRT2          -9.6250     3.3715  -2.8548 0.103924
TRT3          -3.1250     3.3715  -0.9269 0.451839
TRT4           0.0000     0.0000
BLOCK1        -7.6875     3.4548  -2.2252 0.156028
BLOCK2        -4.0625     3.4548  -1.1759 0.360652
BLOCK3        -1.9375     3.4548  -0.5608 0.631370
BLOCK4        -9.3125     3.4548  -2.6955 0.114475
BLOCK5         0.0000     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 9.2 Chapter 2

### 9.2.1 p82

(132) MODEL

```

v2p82 = read.table("C:/G/Rt/Kemp/v2p82.txt", head=TRUE)
v2p82 = af(v2p82, c("B", "Tx"))
GLM(Y ~ B + Tx, v2p82) # OK

```

```

$ANOVA
Response : Y
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      14  889.11   63.508    6.3183 0.000518 ***
RESIDUALS    15  150.77   10.052
CORRECTED TOTAL 29 1039.89
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
B       9 730.39   81.154    8.0738 0.0002454 ***
Tx      5 158.73   31.745    3.1583 0.0381655 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
B       9 595.74   66.193    6.5854 0.0007602 ***
Tx      5 158.73   31.745    3.1583 0.0381655 *
---

```

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
B	9	595.74	66.193	6.5854	0.0007602 ***
Tx	5	158.73	31.745	3.1583	0.0381655 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	42.611	2.2418	19.0074	6.589e-12 ***
B1	-3.297	2.7960	-1.1792	0.256667
B2	0.836	2.7960	0.2990	0.769017
B3	-5.100	2.6943	-1.8929	0.077835 .
B4	5.497	2.7960	1.9661	0.068079 .
B5	-0.992	2.7960	-0.3547	0.727775
B6	2.111	2.7960	0.7550	0.461919
B7	2.481	2.6943	0.9207	0.371800
B8	6.131	2.6943	2.2754	0.037989 *
B9	-10.778	2.7960	-3.8547	0.001559 **
B10	0.000	0.0000		
Tx1	-3.300	2.2418	-1.4720	0.161686
Tx2	-5.042	2.2418	-2.2489	0.039971 *
Tx3	-2.900	2.2418	-1.2936	0.215373
Tx4	-3.233	2.2418	-1.4423	0.169778
Tx5	-8.525	2.2418	-3.8027	0.001734 **
Tx6	0.000	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 9.2.2 p87

(133) MODEL

```
v2p87 = read.table("C:/G/Rt/Kemp/v2p87.txt", head=TRUE)
GLM(y ~ x1 + x2 + x3 + x4 + x5 + x6, v2p87) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	5	1613.25	322.65	2.2332	0.2282
RESIDUALS	4	577.91	144.48		
CORRECTED TOTAL	9	2191.16			

\$`Type I`



```

      Df Sum Sq Mean Sq F value Pr(>F)
x1  1 1044.48 1044.48   7.2293 0.05473 .
x2  1   89.79   89.79   0.6215 0.47459
x3  1   10.45   10.45   0.0724 0.80124
x4  1  407.08  407.08   2.8176 0.16854
x5  1   61.44   61.44   0.4253 0.54990
x6  0
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type II`
      Df Sum Sq Mean Sq F value Pr(>F)
x1  0
x2  0
x3  0
x4  0
x5  0
x6  0

```

```

$`Type III`
CAUTION: Singularity Exists !
      Df Sum Sq Mean Sq F value Pr(>F)
x1  0
x2  0
x3  0
x4  0
x5  0
x6  0

```

```

$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept)  131.100     19.3815   6.7642 0.002492 **
x1           11.800      9.8142   1.2023 0.295540
x2          -13.533      9.8142  -1.3790 0.239998
x3           -5.800      9.8142  -0.5910 0.586312
x4          -17.467      9.8142  -1.7797 0.149731
x5           -6.400      9.8142  -0.6521 0.549902
x6            0.000      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 9.3 Chapter 6

### 9.3.1 p217

(134) MODEL

```
v2p217 = read.table("C:/G/Rt/Kemp/v2p217.txt", head=TRUE)
v2p217 = af(v2p217, c("R", "C", "Tx"))
GLM(Y ~ R + C + Tx, v2p217) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	22	4305.1	195.687	7.5094	0.0002682 ***
RESIDUALS	13	338.8	26.059		
CORRECTED TOTAL	35	4643.9			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	3951.4	1317.15	50.5446	1.998e-07 ***
C	8	168.9	21.11	0.8101	0.6062
Tx	11	184.8	16.80	0.6446	0.7638

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	3403.5	1134.51	43.5360	4.83e-07 ***
C	8	112.4	14.05	0.5390	0.8077
Tx	11	184.8	16.80	0.6446	0.7638

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
R	3	3403.5	1134.51	43.5360	4.83e-07 ***
C	8	112.4	14.05	0.5390	0.8077
Tx	11	184.8	16.80	0.6446	0.7638

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	34.208	4.7371	7.2214	6.733e-06 ***
R1	-25.542	2.5524	-10.0069	1.785e-07 ***
R2	-24.167	2.5524	-9.4682	3.379e-07 ***
R3	-12.458	2.5524	-4.8810	0.0003001 ***
R4	0.000	0.0000		
C1	3.000	4.1681	0.7198	0.4844133
C2	1.444	4.1681	0.3466	0.7344740
C3	5.000	4.1681	1.1996	0.2517026

C4	1.556	4.1681	0.3732	0.7150083
C5	0.778	4.1681	0.1866	0.8548516
C6	6.333	4.1681	1.5195	0.1525804
C7	2.889	4.1681	0.6931	0.5004420
C8	5.000	4.1681	1.1996	0.2517026
C9	0.000	0.0000		
Tx1	6.569	4.6859	1.4020	0.1843467
Tx2	7.398	4.6859	1.5788	0.1383906
Tx3	6.731	4.6859	1.4366	0.1744722
Tx4	5.366	4.6859	1.1451	0.2728148
Tx5	4.477	4.6859	0.9554	0.3568064
Tx6	8.556	4.8129	1.7776	0.0988490 .
Tx7	6.347	4.6859	1.3545	0.1986361
Tx8	5.032	4.6859	1.0740	0.3023722
Tx9	6.458	4.6859	1.3783	0.1913817
Tx10	8.444	4.8129	1.7546	0.1028594
Tx11	0.620	4.6859	0.1324	0.8967013
Tx12	0.000	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

### 9.3.2 p234

(135) MODEL

```
v2p234 = read.table("C:/G/Rt/Kemp/v2p234.txt", head=TRUE)
v2p234 = af(v2p234, c("R", "C", "Tx"))
GLM(Y ~ C + R + Tx, v2p234) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	13	426.50	32.808	7.0936	0.1302
RESIDUALS	2	9.25	4.625		
CORRECTED TOTAL	15	435.75			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
C	3	16.25	5.417	1.1712	0.49129
R	3	357.25	119.083	25.7477	0.03762 *
Tx	7	53.00	7.571	1.6371	0.43052

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
--	----	--------	---------	---------	--------

```

C   3  10.25   3.417  0.7387 0.6189
R   3 285.50  95.167 20.5766 0.0467 *
Tx  7  53.00   7.571  1.6371 0.4305
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
      Df Sum Sq Mean Sq F value Pr(>F)
C       3  10.25   3.417  0.7387 0.6189
R       3 285.50  95.167 20.5766 0.0467 *
Tx      7  53.00   7.571  1.6371 0.4305
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept)  36.375      2.0117 18.0819 0.003045 **
C1             0.250      1.8625  0.1342 0.905509
C2             2.250      1.8625  1.2081 0.350481
C3             0.000      2.1506  0.0000 1.000000
C4             0.000      0.0000
R1            -9.500      1.8625 -5.1008 0.036352 *
R2            -6.000      1.8625 -3.2215 0.084343 .
R3             1.000      2.1506  0.4650 0.687652
R4             0.000      0.0000
Tx1           -6.250      2.6339 -2.3729 0.140990
Tx2           -6.750      2.8449 -2.3726 0.141016
Tx3           -1.500      2.6339 -0.5695 0.626456
Tx4           -3.000      2.4044 -1.2477 0.338419
Tx5           -2.750      2.8449 -0.9666 0.435712
Tx6           -5.250      2.6339 -1.9932 0.184428
Tx7           -4.500      2.8449 -1.5817 0.254516
Tx8            0.000      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 9.4 Chapter 7

### 9.4.1 p268

(136) MODEL

```

v2p268 = read.table("C:/G/Rt/Kemp/v2p268.txt", head=TRUE)
v2p268 = af(v2p268, c("A", "B", "C"))
GLM(y ~ block + A*B*C, v2p268) # OK

```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	8	1026.00	128.250	24.981	0.0001765 ***
RESIDUALS	7	35.94	5.134		
CORRECTED TOTAL	15	1061.94			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	1	715.56	715.56	139.3791	7.093e-06 ***
A	1	68.06	68.06	13.2574	0.0082753 **
B	1	0.06	0.06	0.0122	0.9152401
A:B	1	0.56	0.56	0.1096	0.7503276
C	1	232.56	232.56	45.2991	0.0002698 ***
A:C	1	0.06	0.06	0.0122	0.9152401
B:C	1	7.56	7.56	1.4730	0.2642229
A:B:C	1	1.56	1.56	0.3043	0.5983312

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	1	715.56	715.56	139.3791	7.093e-06 ***
A	1	68.06	68.06	13.2574	0.0082753 **
B	1	0.06	0.06	0.0122	0.9152401
A:B	1	0.56	0.56	0.1096	0.7503276
C	1	232.56	232.56	45.2991	0.0002698 ***
A:C	1	0.06	0.06	0.0122	0.9152401
B:C	1	7.56	7.56	1.4730	0.2642229
A:B:C	1	1.56	1.56	0.3043	0.5983312

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	1	715.56	715.56	139.3791	7.093e-06 ***
A	1	68.06	68.06	13.2574	0.0082753 **
B	1	0.06	0.06	0.0122	0.9152401
A:B	1	0.56	0.56	0.1096	0.7503276
C	1	232.56	232.56	45.2991	0.0002698 ***
A:C	1	0.06	0.06	0.0122	0.9152401
B:C	1	7.56	7.56	1.4730	0.2642229
A:B:C	1	1.56	1.56	0.3043	0.5983312

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	10.938	2.3356	4.6830	0.002253	**
block	13.375	1.1329	11.8059	7.093e-06	***
A0	-4.500	2.2658	-1.9860	0.087400	.
A1	0.000	0.0000			
B0	1.000	2.2658	0.4413	0.672276	
B1	0.000	0.0000			
A0:B0	0.500	3.2043	0.1560	0.880408	
A0:B1	0.000	0.0000			
A1:B0	0.000	0.0000			
A1:B1	0.000	0.0000			
C0	-7.000	2.2658	-3.0894	0.017582	*
C1	0.000	0.0000			
A0:C0	1.500	3.2043	0.4681	0.653929	
A0:C1	0.000	0.0000			
A1:C0	0.000	0.0000			
A1:C1	0.000	0.0000			
B0:C0	-1.500	3.2043	-0.4681	0.653929	
B0:C1	0.000	0.0000			
B1:C0	0.000	0.0000			
B1:C1	0.000	0.0000			
A0:B0:C0	-2.500	4.5316	-0.5517	0.598331	
A0:B0:C1	0.000	0.0000			
A0:B1:C0	0.000	0.0000			
A0:B1:C1	0.000	0.0000			
A1:B0:C0	0.000	0.0000			
A1:B0:C1	0.000	0.0000			
A1:B1:C0	0.000	0.0000			
A1:B1:C1	0.000	0.0000			

---  
Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 9.4.2 p273

(137) MODEL

```
v2p273 = read.table("C:/G/Rt/Kemp/v2p273.txt", head=TRUE)
v2p273 = af(v2p273, c("block", "A", "B", "C"))
GLM(y ~ block + A*B*C + block:A:B:C, v2p273) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	15	2245.0	149.665	129.44	8.427e-14 ***
RESIDUALS	16	18.5	1.156		
CORRECTED TOTAL	31	2263.5			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	1	1498.78	1498.78	1296.2432	< 2.2e-16 ***
A	1	132.03	132.03	114.1892	1.083e-08 ***
B	1	0.03	0.03	0.0270	0.87148
A:B	1	1.53	1.53	1.3243	0.26673
C	1	504.03	504.03	435.9189	4.926e-13 ***
A:C	1	0.78	0.78	0.6757	0.42316
B:C	1	3.78	3.78	3.2703	0.08938 .
A:B:C	1	2.53	2.53	2.1892	0.15840
block:A:B:C	7	101.47	14.50	12.5367	1.965e-05 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	1	1498.78	1498.78	1296.2432	< 2.2e-16 ***
A	1	132.03	132.03	114.1892	1.083e-08 ***
B	1	0.03	0.03	0.0270	0.87148
A:B	1	1.53	1.53	1.3243	0.26673
C	1	504.03	504.03	435.9189	4.926e-13 ***
A:C	1	0.78	0.78	0.6757	0.42316
B:C	1	3.78	3.78	3.2703	0.08938 .
A:B:C	1	2.53	2.53	2.1892	0.15840
block:A:B:C	7	101.47	14.50	12.5367	1.965e-05 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	1	1498.78	1498.78	1296.2432	< 2.2e-16 ***
A	1	132.03	132.03	114.1892	1.083e-08 ***
B	1	0.03	0.03	0.0270	0.87148
A:B	1	1.53	1.53	1.3243	0.26673
C	1	504.03	504.03	435.9189	4.926e-13 ***
A:C	1	0.78	0.78	0.6757	0.42316
B:C	1	3.78	3.78	3.2703	0.08938 .
A:B:C	1	2.53	2.53	2.1892	0.15840
block:A:B:C	7	101.47	14.50	12.5367	1.965e-05 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	41.0	0.76035	53.9229	< 2.2e-16 ***

block1	-18.5	1.07529	-17.2047	9.615e-12	***
block2	0.0	0.00000			
A0	-6.5	1.07529	-6.0449	1.702e-05	***
A1	0.0	0.00000			
B0	-2.0	1.07529	-1.8600	0.0813758	.
B1	0.0	0.00000			
A0:B0	3.5	1.52069	2.3016	0.0351358	*
A0:B1	0.0	0.00000			
A1:B0	0.0	0.00000			
A1:B1	0.0	0.00000			
C0	-9.5	1.07529	-8.8348	1.495e-07	***
C1	0.0	0.00000			
A0:C0	2.5	1.52069	1.6440	0.1196805	
A0:C1	0.0	0.00000			
A1:C0	0.0	0.00000			
A1:C1	0.0	0.00000			
B0:C0	-3.0	1.52069	-1.9728	0.0660548	.
B0:C1	0.0	0.00000			
B1:C0	0.0	0.00000			
B1:C1	0.0	0.00000			
A0:B0:C0	-1.0	2.15058	-0.4650	0.6482037	
A0:B0:C1	0.0	0.00000			
A0:B1:C0	0.0	0.00000			
A0:B1:C1	0.0	0.00000			
A1:B0:C0	0.0	0.00000			
A1:B0:C1	0.0	0.00000			
A1:B1:C0	0.0	0.00000			
A1:B1:C1	0.0	0.00000			
block1:A0:B0:C0	7.0	1.52069	4.6032	0.0002938	***
block1:A0:B0:C1	4.0	1.52069	2.6304	0.0181818	*
block1:A0:B1:C0	3.5	1.52069	2.3016	0.0351358	*
block1:A0:B1:C1	3.5	1.52069	2.3016	0.0351358	*
block1:A1:B0:C0	13.0	1.52069	8.5487	2.321e-07	***
block1:A1:B0:C1	3.5	1.52069	2.3016	0.0351358	*
block1:A1:B1:C0	4.0	1.52069	2.6304	0.0181818	*
block1:A1:B1:C1	0.0	0.00000			
block2:A0:B0:C0	0.0	0.00000			
block2:A0:B0:C1	0.0	0.00000			
block2:A0:B1:C0	0.0	0.00000			
block2:A0:B1:C1	0.0	0.00000			
block2:A1:B0:C0	0.0	0.00000			
block2:A1:B0:C1	0.0	0.00000			
block2:A1:B1:C0	0.0	0.00000			
block2:A1:B1:C1	0.0	0.00000			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1



## 9.5 Chapter 8

### 9.5.1 p304

(138) MODEL

```
v2p304 = read.table("C:/G/Rt/Kemp/v2p304.txt", head=TRUE)
v2p304 = af(v2p304, c("rep", "block", "A", "B", "C"))
GLM(y ~ rep + block %in% rep + A*B*C - A:B:C, v2p304) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	9	699.06	77.674	248.56	5.096e-07 ***
RESIDUALS	6	1.88	0.312		
CORRECTED TOTAL	15	700.94			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	390.06	390.06	1248.2	3.428e-08 ***
rep:block	2	8.12	4.06	13.0	0.0065918 **
A	1	18.06	18.06	57.8	0.0002696 ***
B	1	175.56	175.56	561.8	3.702e-07 ***
A:B	1	0.06	0.06	0.2	0.6704121
C	1	68.06	68.06	217.8	6.083e-06 ***
A:C	1	0.06	0.06	0.2	0.6704121
B:C	1	39.06	39.06	125.0	3.056e-05 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	390.06	390.06	1248.2	3.428e-08 ***
rep:block	2	8.12	4.06	13.0	0.0065918 **
A	1	18.06	18.06	57.8	0.0002696 ***
B	1	175.56	175.56	561.8	3.702e-07 ***
A:B	1	0.06	0.06	0.2	0.6704121
C	1	68.06	68.06	217.8	6.083e-06 ***
A:C	1	0.06	0.06	0.2	0.6704121
B:C	1	39.06	39.06	125.0	3.056e-05 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
--	----	--------	---------	---------	--------

rep	1	390.06	390.06	1248.2	3.428e-08	***
rep:block	2	8.12	4.06	13.0	0.0065918	**
A	1	18.06	18.06	57.8	0.0002696	***
B	1	175.56	175.56	561.8	3.702e-07	***
A:B	1	0.06	0.06	0.2	0.6704121	
C	1	68.06	68.06	217.8	6.083e-06	***
A:C	1	0.06	0.06	0.2	0.6704121	
B:C	1	39.06	39.06	125.0	3.056e-05	***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	35.625	0.44194	80.6102	2.454e-10	***
rep1	-10.250	0.39528	-25.9307	2.169e-07	***
rep2	0.000	0.00000			
rep1:block1	1.750	0.39528	4.4272	0.004436	**
rep1:block2	0.000	0.00000			
rep1:block3	0.000	0.00000			
rep1:block4	0.000	0.00000			
rep2:block1	0.000	0.00000			
rep2:block2	0.000	0.00000			
rep2:block3	1.000	0.39528	2.5298	0.044690	*
rep2:block4	0.000	0.00000			
A0	-2.375	0.48412	-4.9058	0.002695	**
A1	0.000	0.00000			
B0	-9.875	0.48412	-20.3977	9.026e-07	***
B1	0.000	0.00000			
A0:B0	0.250	0.55902	0.4472	0.670412	
A0:B1	0.000	0.00000			
A1:B0	0.000	0.00000			
A1:B1	0.000	0.00000			
C0	-7.375	0.48412	-15.2337	5.051e-06	***
C1	0.000	0.00000			
A0:C0	0.250	0.55902	0.4472	0.670412	
A0:C1	0.000	0.00000			
A1:C0	0.000	0.00000			
A1:C1	0.000	0.00000			
B0:C0	6.250	0.55902	11.1803	3.056e-05	***
B0:C1	0.000	0.00000			
B1:C0	0.000	0.00000			
B1:C1	0.000	0.00000			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

### 9.5.2 p309

(139) MODEL

```
GLM(y ~ rep*A*B*C, v2p304) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	15	700.94	46.729		
RESIDUALS	0	0.00			
CORRECTED TOTAL	15	700.94			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	390.06	390.06		
A	1	18.06	18.06		
rep:A	1	0.06	0.06		
B	1	175.56	175.56		
rep:B	1	1.56	1.56		
A:B	1	0.06	0.06		
rep:A:B	1	0.06	0.06		
C	1	68.06	68.06		
rep:C	1	0.06	0.06		
A:C	1	0.06	0.06		
rep:A:C	1	0.06	0.06		
B:C	1	39.06	39.06		
rep:B:C	1	0.06	0.06		
A:B:C	1	7.56	7.56		
rep:A:B:C	1	0.56	0.56		

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	390.06	390.06		
A	1	18.06	18.06		
rep:A	1	0.06	0.06		
B	1	175.56	175.56		
rep:B	1	1.56	1.56		
A:B	1	0.06	0.06		
rep:A:B	1	0.06	0.06		
C	1	68.06	68.06		
rep:C	1	0.06	0.06		
A:C	1	0.06	0.06		
rep:A:C	1	0.06	0.06		
B:C	1	39.06	39.06		
rep:B:C	1	0.06	0.06		
A:B:C	1	7.56	7.56		

```
rep:A:B:C 1 0.56 0.56
```

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	390.06	390.06		
A	1	18.06	18.06		
rep:A	1	0.06	0.06		
B	1	175.56	175.56		
rep:B	1	1.56	1.56		
A:B	1	0.06	0.06		
rep:A:B	1	0.06	0.06		
C	1	68.06	68.06		
rep:C	1	0.06	0.06		
A:C	1	0.06	0.06		
rep:A:C	1	0.06	0.06		
B:C	1	39.06	39.06		
rep:B:C	1	0.06	0.06		
A:B:C	1	7.56	7.56		
rep:A:B:C	1	0.56	0.56		

```
$Parameter
```

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	35			
rep1	-9			
rep2	0			
A0	-1			
A1	0			
rep1:A0	0			
rep1:A1	0			
rep2:A0	0			
rep2:A1	0			
B0	-8			
B1	0			
rep1:B0	-1			
rep1:B1	0			
rep2:B0	0			
rep2:B1	0			
A0:B0	-2			
A0:B1	0			
A1:B0	0			
A1:B1	0			
rep1:A0:B0	-1			
rep1:A0:B1	0			
rep1:A1:B0	0			
rep1:A1:B1	0			
rep2:A0:B0	0			
rep2:A0:B1	0			
rep2:A1:B0	0			

rep2:A1:B1	0
C0	-6
C1	0
rep1:C0	0
rep1:C1	0
rep2:C0	0
rep2:C1	0
A0:C0	-2
A0:C1	0
A1:C0	0
A1:C1	0
rep1:A0:C0	-1
rep1:A0:C1	0
rep1:A1:C0	0
rep1:A1:C1	0
rep2:A0:C0	0
rep2:A0:C1	0
rep2:A1:C0	0
rep2:A1:C1	0
B0:C0	4
B0:C1	0
B1:C0	0
B1:C1	0
rep1:B0:C0	-1
rep1:B0:C1	0
rep1:B1:C0	0
rep1:B1:C1	0
rep2:B0:C0	0
rep2:B0:C1	0
rep2:B1:C0	0
rep2:B1:C1	0
A0:B0:C0	4
A0:B0:C1	0
A0:B1:C0	0
A0:B1:C1	0
A1:B0:C0	0
A1:B0:C1	0
A1:B1:C0	0
A1:B1:C1	0
rep1:A0:B0:C0	3
rep1:A0:B0:C1	0
rep1:A0:B1:C0	0
rep1:A0:B1:C1	0
rep1:A1:B0:C0	0
rep1:A1:B0:C1	0
rep1:A1:B1:C0	0
rep1:A1:B1:C1	0
rep2:A0:B0:C0	0

```
rep2:A0:B0:C1      0
rep2:A0:B1:C0      0
rep2:A0:B1:C1      0
rep2:A1:B0:C0      0
rep2:A1:B0:C1      0
rep2:A1:B1:C0      0
rep2:A1:B1:C1      0
```

## 9.6 Chapter 9

### 9.6.1 p343

(140) MODEL

```
v2p343 = read.table("C:/G/Rt/Kemp/v2p343.txt", head=TRUE)
v2p343 = af(v2p343, c("rep", "block", "A", "B", "C"))
GLM(y ~ rep + block %in% rep + A*B*C - A:B:C, v2p343) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	17	1889.8	111.167	14.659	0.001608 **
RESIDUALS	6	45.5	7.583		
CORRECTED TOTAL	23	1935.3			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	2	1537.33	768.67	101.3626	2.375e-05 ***
rep:block	9	127.00	14.11	1.8608	0.23163
A	1	36.00	36.00	4.7473	0.07218 .
B	1	36.00	36.00	4.7473	0.07218 .
A:B	1	12.25	12.25	1.6154	0.25079
C	1	56.25	56.25	7.4176	0.03448 *
A:C	1	81.00	81.00	10.6813	0.01707 *
B:C	1	4.00	4.00	0.5275	0.49502

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	2	1537.33	768.67	101.3626	2.375e-05 ***
rep:block	9	119.83	13.31	1.7558	0.25388
A	1	36.00	36.00	4.7473	0.07218 .
B	1	36.00	36.00	4.7473	0.07218 .

```

A:B      1    12.25    12.25    1.6154    0.25079
C        1    56.25    56.25    7.4176    0.03448 *
A:C      1    81.00    81.00   10.6813    0.01707 *
B:C      1     4.00     4.00    0.5275    0.49502
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type III`

```

      Df  Sum Sq Mean Sq  F value    Pr(>F)
rep      2 1537.33  768.67 101.3626 2.375e-05 ***
rep:block 9  119.83   13.31   1.7558  0.25388
A        1   36.00   36.00   4.7473  0.07218 .
B        1   36.00   36.00   4.7473  0.07218 .
A:B      1   12.25   12.25   1.6154  0.25079
C        1   56.25   56.25   7.4176  0.03448 *
A:C      1   81.00   81.00  10.6813  0.01707 *
B:C      1    4.00    4.00   0.5275  0.49502
---

```

```

Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$Parameter

```

      Estimate Std. Error t value  Pr(>|t|)
(Intercept)    40.50      2.3848  16.9822 2.666e-06 ***
rep1           -22.75      3.0788  -7.3892 0.0003153 ***
rep2           -17.75      3.0788  -5.7652 0.0011880 **
rep3             0.00      0.0000
rep1:block1     1.25      3.0788   0.4060 0.6988260
rep1:block2     4.50      3.3727   1.3342 0.2305270
rep1:block3     3.25      3.0788   1.0556 0.3317912
rep1:block4     0.00      0.0000
rep1:block5     0.00      0.0000
rep1:block6     0.00      0.0000
rep1:block7     0.00      0.0000
rep1:block8     0.00      0.0000
rep1:block9     0.00      0.0000
rep1:block10    0.00      0.0000
rep1:block11    0.00      0.0000
rep1:block12    0.00      0.0000
rep2:block1     0.00      0.0000
rep2:block2     0.00      0.0000
rep2:block3     0.00      0.0000
rep2:block4     0.00      0.0000
rep2:block5     9.00      3.0788   2.9232 0.0265209 *
rep2:block6     7.50      3.3727   2.2237 0.0678471 .
rep2:block7     4.50      3.0788   1.4616 0.1941629
rep2:block8     0.00      0.0000
rep2:block9     0.00      0.0000
rep2:block10    0.00      0.0000

```

```

rep2:block11      0.00      0.0000
rep2:block12      0.00      0.0000
rep3:block1       0.00      0.0000
rep3:block2       0.00      0.0000
rep3:block3       0.00      0.0000
rep3:block4       0.00      0.0000
rep3:block5       0.00      0.0000
rep3:block6       0.00      0.0000
rep3:block7       0.00      0.0000
rep3:block8       0.00      0.0000
rep3:block9       0.50      3.0788  0.1624 0.8763224
rep3:block10      -5.00      3.3727 -1.4825 0.1887247
rep3:block11      0.50      3.0788  0.1624 0.8763224
rep3:block12      0.00      0.0000
A0                -9.25      2.3848 -3.8787 0.0081834 **
A1                0.00      0.0000
B0                -3.75      2.3848 -1.5724 0.1669121
B1                0.00      0.0000
A0:B0             3.50      2.7538  1.2710 0.2507870
A0:B1             0.00      0.0000
A1:B0             0.00      0.0000
A1:B1             0.00      0.0000
C0               -7.25      2.3848 -3.0400 0.0228021 *
C1                0.00      0.0000
A0:C0             9.00      2.7538  3.2682 0.0170720 *
A0:C1             0.00      0.0000
A1:C0             0.00      0.0000
A1:C1             0.00      0.0000
B0:C0            -2.00      2.7538 -0.7263 0.4950160
B0:C1             0.00      0.0000
B1:C0             0.00      0.0000
B1:C1             0.00      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 9.6.2 p348

(141) MODEL

```
GLM(y ~ rep + A*B*C + block %in% rep, v2p343) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	17	1889.8	111.167	14.659	0.001608 **
RESIDUALS	6	45.5	7.583		



CORRECTED TOTAL 23 1935.3

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
rep	2	1537.33	768.67	101.3626	2.375e-05	***
A	1	88.17	88.17	11.6264	0.01432	*
B	1	37.50	37.50	4.9451	0.06785	.
A:B	1	2.67	2.67	0.3516	0.57484	
C	1	66.67	66.67	8.7912	0.02512	*
A:C	1	37.50	37.50	4.9451	0.06785	.
B:C	1	0.17	0.17	0.0220	0.88700	
A:B:C	1	24.00	24.00	3.1648	0.12555	
rep:block	8	95.83	11.98	1.5797	0.29730	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
rep	2	1537.33	768.67	101.3626	2.375e-05	***
A	1	36.00	36.00	4.7473	0.07218	.
B	1	36.00	36.00	4.7473	0.07218	.
A:B	1	12.25	12.25	1.6154	0.25079	
C	1	56.25	56.25	7.4176	0.03448	*
A:C	1	81.00	81.00	10.6813	0.01707	*
B:C	1	4.00	4.00	0.5275	0.49502	
A:B:C	0					
rep:block	8	95.83	11.98	1.5797	0.29730	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
rep	2	1537.33	768.67	101.3626	2.375e-05	***
A	1	36.00	36.00	4.7473	0.07218	.
B	1	36.00	36.00	4.7473	0.07218	.
A:B	1	12.25	12.25	1.6154	0.25079	
C	1	56.25	56.25	7.4176	0.03448	*
A:C	1	81.00	81.00	10.6813	0.01707	*
B:C	1	4.00	4.00	0.5275	0.49502	
A:B:C	0					
rep:block	8	95.83	11.98	1.5797	0.29730	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	40.50	2.3848	16.9822	2.666e-06	***
rep1	-22.75	3.0788	-7.3892	0.0003153	***
rep2	-17.75	3.0788	-5.7652	0.0011880	**
rep3	0.00	0.0000			
A0	-8.75	3.3727	-2.5944	0.0409706	*
A1	0.00	0.0000			
B0	-3.25	3.8944	-0.8345	0.4359464	
B1	0.00	0.0000			
A0:B0	2.50	6.7454	0.3706	0.7236497	
A0:B1	0.00	0.0000			
A1:B0	0.00	0.0000			
A1:B1	0.00	0.0000			
C0	-6.75	3.8944	-1.7332	0.1337546	
C1	0.00	0.0000			
A0:C0	8.00	6.7454	1.1860	0.2804551	
A0:C1	0.00	0.0000			
A1:C0	0.00	0.0000			
A1:C1	0.00	0.0000			
B0:C0	-3.00	6.7454	-0.4447	0.6720948	
B0:C1	0.00	0.0000			
B1:C0	0.00	0.0000			
B1:C1	0.00	0.0000			
A0:B0:C0	2.00	12.3153	0.1624	0.8763224	
A0:B0:C1	0.00	0.0000			
A0:B1:C0	0.00	0.0000			
A0:B1:C1	0.00	0.0000			
A1:B0:C0	0.00	0.0000			
A1:B0:C1	0.00	0.0000			
A1:B1:C0	0.00	0.0000			
A1:B1:C1	0.00	0.0000			
rep1:block1	0.75	4.3541	0.1723	0.8689036	
rep1:block2	4.50	3.3727	1.3342	0.2305270	
rep1:block3	2.75	4.3541	0.6316	0.5509461	
rep1:block4	0.00	0.0000			
rep1:block5	0.00	0.0000			
rep1:block6	0.00	0.0000			
rep1:block7	0.00	0.0000			
rep1:block8	0.00	0.0000			
rep1:block9	0.00	0.0000			
rep1:block10	0.00	0.0000			
rep1:block11	0.00	0.0000			
rep1:block12	0.00	0.0000			
rep2:block1	0.00	0.0000			
rep2:block2	0.00	0.0000			
rep2:block3	0.00	0.0000			
rep2:block4	0.00	0.0000			
rep2:block5	8.50	4.3541	1.9522	0.0987607	.

```

rep2:block6      7.50      3.3727  2.2237 0.0678471 .
rep2:block7      4.00      4.3541  0.9187 0.3936995
rep2:block8      0.00      0.0000
rep2:block9      0.00      0.0000
rep2:block10     0.00      0.0000
rep2:block11     0.00      0.0000
rep2:block12     0.00      0.0000
rep3:block1      0.00      0.0000
rep3:block2      0.00      0.0000
rep3:block3      0.00      0.0000
rep3:block4      0.00      0.0000
rep3:block5      0.00      0.0000
rep3:block6      0.00      0.0000
rep3:block7      0.00      0.0000
rep3:block8      0.00      0.0000
rep3:block9      0.00      3.3727  0.0000 1.0000000
rep3:block10     -5.00      3.3727 -1.4825 0.1887247
rep3:block11     0.00      0.0000
rep3:block12     0.00      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

### 9.6.3 p353

(142) MODEL

```

v2p353 = read.table("C:/G/Rt/Kemp/v2p353.txt", head=TRUE)
v2p353 = af(v2p353, c("rep", "block", "A", "B", "C", "D"))
GLM(y ~ rep + rep:block + A*B*C*D - A:B:C:D, v2p353) # OK

```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	21	7132.2	339.63	56.022	9.795e-08 ***
RESIDUALS	10	60.6	6.06		
CORRECTED TOTAL	31	7192.9			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	5940.5	5940.5	979.8763	2.600e-11 ***
rep:block	6	777.4	129.6	21.3711	3.675e-05 ***
A	1	171.1	171.1	28.2268	0.0003412 ***
B	1	18.0	18.0	2.9691	0.1155937
A:B	1	1.6	1.6	0.2577	0.6226914

C	1	120.1	120.1	19.8144	0.0012326	**
A:C	1	0.6	0.6	0.0928	0.7669127	
B:C	1	2.0	2.0	0.3299	0.5784103	
A:B:C	1	4.5	4.5	0.7423	0.4091189	
D	1	6.1	6.1	1.0103	0.3385304	
A:D	1	1.1	1.1	0.1856	0.6757693	
B:D	1	5.1	5.1	0.8351	0.3823203	
A:B:D	1	0.5	0.5	0.0825	0.7798349	
C:D	1	1.6	1.6	0.2577	0.6226914	
A:C:D	1	10.1	10.1	1.6701	0.2253083	
B:C:D	1	72.0	72.0	11.8763	0.0062660	**

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
rep	1	5940.5	5940.5	979.8763	2.6e-11	***
rep:block	6	406.9	67.8	11.1856	0.0006129	***
A	1	171.1	171.1	28.2268	0.0003412	***
B	1	18.0	18.0	2.9691	0.1155937	
A:B	1	1.6	1.6	0.2577	0.6226914	
C	1	120.1	120.1	19.8144	0.0012326	**
A:C	1	0.6	0.6	0.0928	0.7669127	
B:C	1	2.0	2.0	0.3299	0.5784103	
A:B:C	1	4.5	4.5	0.7423	0.4091189	
D	1	6.1	6.1	1.0103	0.3385304	
A:D	1	1.1	1.1	0.1856	0.6757693	
B:D	1	5.1	5.1	0.8351	0.3823203	
A:B:D	1	0.5	0.5	0.0825	0.7798349	
C:D	1	1.6	1.6	0.2577	0.6226914	
A:C:D	1	10.1	10.1	1.6701	0.2253083	
B:C:D	1	72.0	72.0	11.8763	0.0062660	**

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
rep	1	5940.5	5940.5	979.8763	2.6e-11	***
rep:block	6	406.9	67.8	11.1856	0.0006129	***
A	1	171.1	171.1	28.2268	0.0003412	***
B	1	18.0	18.0	2.9691	0.1155937	
A:B	1	1.6	1.6	0.2577	0.6226914	
C	1	120.1	120.1	19.8144	0.0012326	**
A:C	1	0.6	0.6	0.0928	0.7669127	
B:C	1	2.0	2.0	0.3299	0.5784103	
A:B:C	1	4.5	4.5	0.7423	0.4091189	
D	1	6.1	6.1	1.0103	0.3385304	
A:D	1	1.1	1.1	0.1856	0.6757693	

B:D	1	5.1	5.1	0.8351	0.3823203
A:B:D	1	0.5	0.5	0.0825	0.7798349
C:D	1	1.6	1.6	0.2577	0.6226914
A:C:D	1	10.1	10.1	1.6701	0.2253083
B:C:D	1	72.0	72.0	11.8763	0.0062660 **

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	61.438	2.0416	30.0934	3.842e-11	***
rep1	-32.875	2.1323	-15.4173	2.685e-08	***
rep2	0.000	0.0000			
rep1:block1	-3.125	2.1323	-1.4655	0.1735006	
rep1:block2	5.250	2.4622	2.1322	0.0588002	.
rep1:block3	9.125	2.1323	4.2793	0.0016131	**
rep1:block4	0.000	0.0000			
rep1:block5	0.000	0.0000			
rep1:block6	0.000	0.0000			
rep1:block7	0.000	0.0000			
rep1:block8	0.000	0.0000			
rep2:block1	0.000	0.0000			
rep2:block2	0.000	0.0000			
rep2:block3	0.000	0.0000			
rep2:block4	0.000	0.0000			
rep2:block5	-10.625	2.1323	-4.9828	0.0005512	***
rep2:block6	-4.250	2.4622	-1.7261	0.1150383	
rep2:block7	3.625	2.1323	1.7000	0.1199674	
rep2:block8	0.000	0.0000			
A0	-6.375	2.6116	-2.4411	0.0347860	*
A1	0.000	0.0000			
B0	-3.750	2.6116	-1.4359	0.1815604	
B1	0.000	0.0000			
A0:B0	-0.250	3.4821	-0.0718	0.9441800	
A0:B1	0.000	0.0000			
A1:B0	0.000	0.0000			
A1:B1	0.000	0.0000			
C0	-10.250	2.6116	-3.9248	0.0028439	**
C1	0.000	0.0000			
A0:C0	4.500	3.4821	1.2923	0.2253083	
A0:C1	0.000	0.0000			
A1:C0	0.000	0.0000			
A1:C1	0.000	0.0000			
B0:C0	8.500	3.0156	2.8187	0.0182015	*
B0:C1	0.000	0.0000			
B1:C0	0.000	0.0000			
B1:C1	0.000	0.0000			
A0:B0:C0	-3.000	3.4821	-0.8615	0.4091189	

A0:B0:C1	0.000	0.0000		
A0:B1:C0	0.000	0.0000		
A0:B1:C1	0.000	0.0000		
A1:B0:C0	0.000	0.0000		
A1:B0:C1	0.000	0.0000		
A1:B1:C0	0.000	0.0000		
A1:B1:C1	0.000	0.0000		
D0	-4.625	2.6116	-1.7710	0.1069851
D1	0.000	0.0000		
A0:D0	2.500	3.0156	0.8290	0.4264346
A0:D1	0.000	0.0000		
A1:D0	0.000	0.0000		
A1:D1	0.000	0.0000		
B0:D0	3.250	3.4821	0.9333	0.3726292
B0:D1	0.000	0.0000		
B1:D0	0.000	0.0000		
B1:D1	0.000	0.0000		
A0:B0:D0	1.000	3.4821	0.2872	0.7798349
A0:B0:D1	0.000	0.0000		
A0:B1:D0	0.000	0.0000		
A0:B1:D1	0.000	0.0000		
A1:B0:D0	0.000	0.0000		
A1:B0:D1	0.000	0.0000		
A1:B1:D0	0.000	0.0000		
A1:B1:D1	0.000	0.0000		
C0:D0	9.500	3.4821	2.7282	0.0212575 *
C0:D1	0.000	0.0000		
C1:D0	0.000	0.0000		
C1:D1	0.000	0.0000		
A0:C0:D0	-4.500	3.4821	-1.2923	0.2253083
A0:C0:D1	0.000	0.0000		
A0:C1:D0	0.000	0.0000		
A0:C1:D1	0.000	0.0000		
A1:C0:D0	0.000	0.0000		
A1:C0:D1	0.000	0.0000		
A1:C1:D0	0.000	0.0000		
A1:C1:D1	0.000	0.0000		
B0:C0:D0	-12.000	3.4821	-3.4462	0.0062660 **
B0:C0:D1	0.000	0.0000		
B0:C1:D0	0.000	0.0000		
B0:C1:D1	0.000	0.0000		
B1:C0:D0	0.000	0.0000		
B1:C0:D1	0.000	0.0000		
B1:C1:D0	0.000	0.0000		
B1:C1:D1	0.000	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 9.7 Chapter 10

### 9.7.1 p388

(143) MODEL

```
v2p388 = read.table("C:/G/Rt/Kemp/v2p388.txt", head=TRUE)
v2p388 = af(v2p388, c("rep", "block", "A", "B"))
GLM(y ~ rep + A*B + rep:block, v2p388) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	11	1136.8	103.343	124.01	3.698e-06 ***
RESIDUALS	6	5.0	0.833		
CORRECTED TOTAL	17	1141.8			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	410.89	410.89	493.0667	5.455e-07 ***
A	2	228.11	114.06	136.8667	9.868e-06 ***
B	2	3.44	1.72	2.0667	0.207585
A:B	4	464.22	116.06	139.2667	4.801e-06 ***
rep:block	2	30.11	15.06	18.0667	0.002888 **

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	410.89	410.89	493.0667	5.455e-07 ***
A	2	228.11	114.06	136.8667	9.868e-06 ***
B	2	3.44	1.72	2.0667	0.207585
A:B	2	18.78	9.39	11.2667	0.009298 **
rep:block	2	30.11	15.06	18.0667	0.002888 **

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
rep	1	410.89	410.89	493.0667	5.455e-07 ***
A	2	228.11	114.06	136.8667	9.868e-06 ***
B	2	3.44	1.72	2.0667	0.207585
A:B	2	18.78	9.39	11.2667	0.009298 **
rep:block	2	30.11	15.06	18.0667	0.002888 **

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	42.833	0.74536	57.4669	1.865e-09	***
rep1	-12.667	0.74536	-16.9941	2.655e-06	***
rep2	0.000	0.00000			
A0	-16.167	1.05409	-15.3370	4.854e-06	***
A1	-18.500	1.05409	-17.5506	2.196e-06	***
A2	0.000	0.00000			
B0	-10.167	1.05409	-9.6449	7.115e-05	***
B1	-13.500	1.05409	-12.8072	1.392e-05	***
B2	0.000	0.00000			
A0:B0	3.833	1.58114	2.4244	0.0515527	.
A0:B1	18.667	1.58114	11.8058	2.232e-05	***
A0:B2	0.000	0.00000			
A1:B0	26.167	1.58114	16.5493	3.104e-06	***
A1:B1	18.833	1.58114	11.9112	2.120e-05	***
A1:B2	0.000	0.00000			
A2:B0	0.000	0.00000			
A2:B1	0.000	0.00000			
A2:B2	0.000	0.00000			
rep1:block1	3.000	1.05409	2.8460	0.0293332	*
rep1:block2	6.333	1.05409	6.0083	0.0009575	***
rep1:block3	0.000	0.00000			
rep1:block4	0.000	0.00000			
rep1:block5	0.000	0.00000			
rep1:block6	0.000	0.00000			
rep2:block1	0.000	0.00000			
rep2:block2	0.000	0.00000			
rep2:block3	0.000	0.00000			
rep2:block4	0.000	0.00000			
rep2:block5	0.000	0.00000			
rep2:block6	0.000	0.00000			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 9.8 Chapter 14

### 9.8.1 p570

(144) MODEL

```
v2p570 = read.table("C:/G/Rt/Kemp/v2p570.txt", head=TRUE)
v2p570 = af(v2p570, c("A", "B", "C", "D"))
GLM(Y ~ A + B + C + D + A:B + A:C + A:D + B:C + B:D + C:D, v2p570) # OK
```



\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	8	22.222	2.7778		
RESIDUALS	0	0.000			
CORRECTED TOTAL	8	22.222			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	2	2.8889	1.4444		
B	2	2.8889	1.4444		
C	2	1.5556	0.7778		
D	2	14.8889	7.4444		
A:B	0				
A:C	0				
A:D	0				
B:C	0				
B:D	0				
C:D	0				

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	0				
B	0				
C	0				
D	0				
A:B	0				
A:C	0				
A:D	0				
B:C	0				
B:D	0				
C:D	0				

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	0				
B	0				
C	0				
D	0				
A:B	0				
A:C	0				
A:D	0				
B:C	0				
B:D	0				
C:D	0				

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	9.3333			
A0	-1.3333			
A1	-1.0000			
A2	0.0000			
B0	-0.3333			
B1	1.0000			
B2	0.0000			
C0	-0.3333			
C1	-1.0000			
C2	0.0000			
D0	-2.3333			
D1	-3.0000			
D2	0.0000			
A0:B0	0.0000			
A0:B1	0.0000			
A0:B2	0.0000			
A1:B0	0.0000			
A1:B1	0.0000			
A1:B2	0.0000			
A2:B0	0.0000			
A2:B1	0.0000			
A2:B2	0.0000			
A0:C0	0.0000			
A0:C1	0.0000			
A0:C2	0.0000			
A1:C0	0.0000			
A1:C1	0.0000			
A1:C2	0.0000			
A2:C0	0.0000			
A2:C1	0.0000			
A2:C2	0.0000			
A0:D0	0.0000			
A0:D1	0.0000			
A0:D2	0.0000			
A1:D0	0.0000			
A1:D1	0.0000			
A1:D2	0.0000			
A2:D0	0.0000			
A2:D1	0.0000			
A2:D2	0.0000			
B0:C0	0.0000			
B0:C1	0.0000			
B0:C2	0.0000			
B1:C0	0.0000			
B1:C1	0.0000			
B1:C2	0.0000			
B2:C0	0.0000			

B2:C1	0.0000
B2:C2	0.0000
B0:D0	0.0000
B0:D1	0.0000
B0:D2	0.0000
B1:D0	0.0000
B1:D1	0.0000
B1:D2	0.0000
B2:D0	0.0000
B2:D1	0.0000
B2:D2	0.0000
C0:D0	0.0000
C0:D1	0.0000
C0:D2	0.0000
C1:D0	0.0000
C1:D1	0.0000
C1:D2	0.0000
C2:D0	0.0000
C2:D1	0.0000
C2:D2	0.0000

## 9.8.2 p578

(145) MODEL

```
v2p578 = read.table("C:/G/Rt/Kemp/v2p578.txt", head=TRUE)
v2p578 = af(v2p578, 1:11)
GLM(Y ~ A + B + C + D + E + F + G + H + J + K + L, v2p578) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	11	575	52.273		
RESIDUALS	0	0			
CORRECTED TOTAL	11	575			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	3.000	3.000		
B	1	27.000	27.000		
C	1	12.000	12.000		
D	1	16.333	16.333		
E	1	176.333	176.333		
F	1	133.333	133.333		
G	1	1.333	1.333		
H	1	21.333	21.333		

J	1	108.000	108.000
K	1	1.333	1.333
L	1	75.000	75.000

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	3.000	3.000		
B	1	27.000	27.000		
C	1	12.000	12.000		
D	1	16.333	16.333		
E	1	176.333	176.333		
F	1	133.333	133.333		
G	1	1.333	1.333		
H	1	21.333	21.333		
J	1	108.000	108.000		
K	1	1.333	1.333		
L	1	75.000	75.000		

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	3.000	3.000		
B	1	27.000	27.000		
C	1	12.000	12.000		
D	1	16.333	16.333		
E	1	176.333	176.333		
F	1	133.333	133.333		
G	1	1.333	1.333		
H	1	21.333	21.333		
J	1	108.000	108.000		
K	1	1.333	1.333		
L	1	75.000	75.000		

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	21.0000			
A0	1.0000			
A1	0.0000			
B0	3.0000			
B1	0.0000			
C0	2.0000			
C1	0.0000			
D0	2.3333			
D1	0.0000			
E0	7.6667			
E1	0.0000			
F0	6.6667			
F1	0.0000			
G0	0.6667			

G1	0.0000
H0	-2.6667
H1	0.0000
J0	-6.0000
J1	0.0000
K0	-0.6667
K1	0.0000
L0	-5.0000
L1	0.0000

(146) MODEL

```
GLM(Y ~ E*F + E*J + F*J + E*L + F*L + J*L, v2p578) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	10	574.5	57.45	114.9	0.07249 .
RESIDUALS	1	0.5	0.50		
CORRECTED TOTAL	11	575.0			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
E	1	176.333	176.333	352.6667	0.03387 *
F	1	133.333	133.333	266.6667	0.03894 *
E:F	1	65.333	65.333	130.6667	0.05555 .
J	1	66.667	66.667	133.3333	0.05500 .
E:J	1	2.667	2.667	5.3333	0.26015
F:J	1	112.667	112.667	225.3333	0.04235 *
L	1	10.800	10.800	21.6000	0.13492
E:L	1	5.486	5.486	10.9714	0.18666
F:L	1	0.176	0.176	0.3516	0.65925
J:L	1	1.038	1.038	2.0769	0.38618

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
E	1	61.633	61.633	123.2667	0.05719 .
F	1	75.208	75.208	150.4167	0.05179 .
E:F	1	9.346	9.346	18.6923	0.14470
J	1	54.675	54.675	109.3500	0.06069 .
E:J	1	0.115	0.115	0.2308	0.71490
F:J	1	72.115	72.115	144.2308	0.05289 .
L	1	10.800	10.800	21.6000	0.13492

```
E:L 1 5.654 5.654 11.3077 0.18402
F:L 1 0.115 0.115 0.2308 0.71490
J:L 1 1.038 1.038 2.0769 0.38618
```

```
---
```

```
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
E	1	61.038	61.038	122.0769	0.05746 .
F	1	61.038	61.038	122.0769	0.05746 .
E:F	1	9.346	9.346	18.6923	0.14470
J	1	61.038	61.038	122.0769	0.05746 .
E:J	1	0.115	0.115	0.2308	0.71490
F:J	1	72.115	72.115	144.2308	0.05289 .
L	1	9.346	9.346	18.6923	0.14470
E:L	1	5.654	5.654	11.3077	0.18402
F:L	1	0.115	0.115	0.2308	0.71490
J:L	1	1.038	1.038	2.0769	0.38618

```
---
```

```
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
```

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	26.5	1.1180	23.7023	0.02684 *
E0	6.0	1.1547	5.1962	0.12104
E1	0.0	0.0000		
F0	1.5	1.0408	1.4412	0.38618
F1	0.0	0.0000		
E0:F0	-4.5	1.0408	-4.3235	0.14470
E0:F1	0.0	0.0000		
E1:F0	0.0	0.0000		
E1:F1	0.0	0.0000		
J0	-11.5	1.0408	-11.0488	0.05746 .
J1	0.0	0.0000		
E0:J0	0.5	1.0408	0.4804	0.71490
E0:J1	0.0	0.0000		
E1:J0	0.0	0.0000		
E1:J1	0.0	0.0000		
F0:J0	12.5	1.0408	12.0096	0.05289 .
F0:J1	0.0	0.0000		
F1:J0	0.0	0.0000		
F1:J1	0.0	0.0000		
L0	-3.5	1.0408	-3.3627	0.18402
L1	0.0	0.0000		
E0:L0	3.5	1.0408	3.3627	0.18402
E0:L1	0.0	0.0000		
E1:L0	0.0	0.0000		
E1:L1	0.0	0.0000		

F0:L0	0.5	1.0408	0.4804	0.71490
F0:L1	0.0	0.0000		
F1:L0	0.0	0.0000		
F1:L1	0.0	0.0000		
J0:L0	-1.5	1.0408	-1.4412	0.38618
J0:L1	0.0	0.0000		
J1:L0	0.0	0.0000		
J1:L1	0.0	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 9.9 Chapter 16

### 9.9.1 p619

(147) MODEL

```
v2p619 = read.table("C:/G/Rt/Kemp/v2p619.txt", head=TRUE)
v2p619 = af(v2p619, c("A", "B", "C"))
GLM(y ~ A + B + C + A:B, v2p619) # OK
```

Warning in sqrt(diag(bVar)): NaNs produced

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	4	31.429	7.8571		
RESIDUALS	2	0.000	0.0000		
CORRECTED TOTAL	6	31.429			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	13.7619	13.7619	-2.7424e+14	1
B	1	1.6667	1.6667	-3.3212e+13	1
C	1	10.0000	10.0000	-1.9927e+14	1
A:B	1	6.0000	6.0000	-1.1956e+14	1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	19.6	19.6	-3.9058e+14	1
B	1	3.6	3.6	-7.1739e+13	1
C	1	13.5	13.5	-2.6902e+14	1
A:B	1	6.0	6.0	-1.1956e+14	1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
--	----	--------	---------	---------	--------

A	1	24.0	24.0	-4.7826e+14	1
B	1	6.0	6.0	-1.1956e+14	1
C	1	13.5	13.5	-2.6902e+14	1
A:B	1	6.0	6.0	-1.1956e+14	1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	13.5			
A0	-6.0			
A1	0.0	0		
B0	0.0			
B1	0.0	0		
C0	-3.0			
C1	0.0	0		
A0:B0	4.0			
A0:B1	0.0	0		
A1:B0	0.0	0		
A1:B1	0.0	0		

(148) MODEL

```
GLM(y ~ A + B + C + A:C, v2p619) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	4	26.0952	6.5238	2.4464	0.3106
RESIDUALS	2	5.3333	2.6667		
CORRECTED TOTAL	6	31.4286			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	13.7619	13.7619	5.1607	0.1511
B	1	1.6667	1.6667	0.6250	0.5120
C	1	10.0000	10.0000	3.7500	0.1924
A:C	1	0.6667	0.6667	0.2500	0.6667

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	19.6000	19.6000	7.35	0.1134
B	1	2.6667	2.6667	1.00	0.4226
C	1	10.0000	10.0000	3.75	0.1924
A:C	1	0.6667	0.6667	0.25	0.6667

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	16.6667	16.6667	6.2500	0.1296



```

B    1  2.6667  2.6667  1.0000 0.4226
C    1  8.1667  8.1667  3.0625 0.2222
A:C  1  0.6667  0.6667  0.2500 0.6667

```

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	12.8333	1.3333	9.6250	0.01062 *
A0	-4.0000	1.6330	-2.4495	0.13397
A1	0.0000	0.0000		
B0	1.3333	1.3333	1.0000	0.42265
B1	0.0000	0.0000		
C0	-3.0000	1.6330	-1.8371	0.20759
C1	0.0000	0.0000		
A0:C0	1.3333	2.6667	0.5000	0.66667
A0:C1	0.0000	0.0000		
A1:C0	0.0000	0.0000		
A1:C1	0.0000	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

(149) MODEL

```
GLM(y ~ A + B + C + B:C, v2p619) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	4	26.0952	6.5238	2.4464	0.3106
RESIDUALS	2	5.3333	2.6667		
CORRECTED TOTAL	6	31.4286			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	13.7619	13.7619	5.1607	0.1511
B	1	1.6667	1.6667	0.6250	0.5120
C	1	10.0000	10.0000	3.7500	0.1924
B:C	1	0.6667	0.6667	0.2500	0.6667

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	16.6667	16.6667	6.25	0.1296
B	1	3.6000	3.6000	1.35	0.3652
C	1	10.0000	10.0000	3.75	0.1924
B:C	1	0.6667	0.6667	0.25	0.6667

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
--	----	--------	---------	---------	--------

```

A    1 16.6667 16.6667  6.2500 0.1296
B    1  2.6667  2.6667  1.0000 0.4226
C    1  8.1667  8.1667  3.0625 0.2222
B:C  1  0.6667  0.6667  0.2500 0.6667

```

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	12.1667	1.3333	9.1250	0.0118 *
A0	-3.3333	1.3333	-2.5000	0.1296
A1	0.0000	0.0000		
B0	2.0000	1.6330	1.2247	0.3453
B1	0.0000	0.0000		
C0	-1.6667	2.1082	-0.7906	0.5120
C1	0.0000	0.0000		
B0:C0	-1.3333	2.6667	-0.5000	0.6667
B0:C1	0.0000	0.0000		
B1:C0	0.0000	0.0000		
B1:C1	0.0000	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 9.9.2 p626

(150) MODEL

```

v2p626 = read.table("C:/G/Rt/Kemp/v2p626.txt", head=TRUE)
v2p626 = af(v2p626, c("A", "B", "C"))
GLM(y ~ A + B + C + A:B, v2p626) # OK

```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	4	42.092	10.5231	22.002	0.04395 *
RESIDUALS	2	0.957	0.4783		
CORRECTED TOTAL	6	43.049			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	16.2088	16.2088	33.890	0.02826 *
B	1	4.8150	4.8150	10.068	0.08662 .
C	1	15.7339	15.7339	32.898	0.02908 *
A:B	1	5.3346	5.3346	11.154	0.07916 .

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	25.4131	25.4131	53.136	0.01830 *
B	1	8.6630	8.6630	18.113	0.05102 .
C	1	19.5193	19.5193	40.812	0.02364 *
A:B	1	5.3346	5.3346	11.154	0.07916 .

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	29.7950	29.7950	62.297	0.01568 *
B	1	11.7460	11.7460	24.559	0.03839 *
C	1	19.5193	19.5193	40.812	0.02364 *
A:B	1	5.3346	5.3346	11.154	0.07916 .

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	13.7877	0.56467	24.4174	0.001673 **
A0	-6.3427	0.89281	-7.1041	0.019244 *
A1	0.0000	0.00000		
B0	0.9125	0.69157	1.3195	0.317812
B1	0.0000	0.00000		
C0	-3.6073	0.56467	-6.3884	0.023637 *
C1	0.0000	0.00000		
A0:B0	3.7717	1.12933	3.3397	0.079156 .
A0:B1	0.0000	0.00000		
A1:B0	0.0000	0.00000		
A1:B1	0.0000	0.00000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

(151) MODEL

```
GLM(y ~ A + B + C + A:C, v2p626) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	4	39.229	9.8072	5.1346	0.1696
RESIDUALS	2	3.820	1.9100		
CORRECTED TOTAL	6	43.049			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	16.2088	16.2088	8.4862	0.1004
B	1	4.8150	4.8150	2.5209	0.2533
C	1	15.7339	15.7339	8.2376	0.1030
A:C	1	2.4711	2.4711	1.2937	0.3733

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	25.4131	25.4131	13.3052	0.06762 .
B	1	6.0361	6.0361	3.1602	0.21743
C	1	15.7339	15.7339	8.2376	0.10298
A:C	1	2.4711	2.4711	1.2937	0.37327

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	20.1428	20.1428	10.5459	0.08317 .
B	1	6.0361	6.0361	3.1602	0.21743
C	1	11.8863	11.8863	6.2232	0.13007
A:C	1	2.4711	2.4711	1.2937	0.37327

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	13.4865	1.1284	11.9516	0.006928 **
A0	-4.9480	1.3820	-3.5802	0.069930 .
A1	0.0000	0.0000		
B0	2.0060	1.1284	1.7777	0.217428
B1	0.0000	0.0000		
C0	-4.0985	1.3820	-2.9656	0.097381 .
C1	0.0000	0.0000		
A0:C0	2.5670	2.2569	1.1374	0.373273
A0:C1	0.0000	0.0000		
A1:C0	0.0000	0.0000		
A1:C1	0.0000	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

(152) MODEL

```
GLM(y ~ A + B + C + B:C, v2p626) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
--	----	--------	---------	---------	--------

MODEL	4	37.340	9.3349	3.2701	0.2477
RESIDUALS	2	5.709	2.8546		
CORRECTED TOTAL	6	43.049			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	16.2088	16.2088	5.6781	0.1400
B	1	4.8150	4.8150	1.6867	0.3236
C	1	15.7339	15.7339	5.5118	0.1434
B:C	1	0.5819	0.5819	0.2038	0.6959

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	21.9995	21.9995	7.7067	0.1090
B	1	8.6630	8.6630	3.0347	0.2236
C	1	15.7339	15.7339	5.5118	0.1434
B:C	1	0.5819	0.5819	0.2038	0.6959

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	21.9995	21.9995	7.7067	0.1090
B	1	7.0709	7.0709	2.4770	0.2562
C	1	13.3221	13.3221	4.6669	0.1633
B:C	1	0.5819	0.5819	0.2038	0.6959

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	12.5333	1.3795	9.0853	0.0119 *
A0	-3.8297	1.3795	-2.7761	0.1090
A1	0.0000	0.0000		
B0	2.7940	1.6896	1.6537	0.2400
B1	0.0000	0.0000		
C0	-2.3573	2.1812	-1.0807	0.3928
C1	0.0000	0.0000		
B0:C0	-1.2457	2.7590	-0.4515	0.6959
B0:C1	0.0000	0.0000		
B1:C0	0.0000	0.0000		
B1:C1	0.0000	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 9.10 Chapter 17

### 9.10.1 p642

(153) MODEL

```
v2p642 = read.table("C:/G/Rt/Kemp/v2p642.txt", head=TRUE)
v2p642 = af(v2p642, 2:11)
GLM(Y ~ A + B + C + D + E + F + G, v2p642) # OK
```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	7	11.0	1.57143	1.6688	0.1646
RESIDUALS	24	22.6	0.94167		
CORRECTED TOTAL	31	33.6			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	5.7800	5.7800	6.1381	0.02066 *
B	1	0.1800	0.1800	0.1912	0.66587
C	1	0.1250	0.1250	0.1327	0.71879
D	1	2.5312	2.5312	2.6881	0.11415
E	1	0.6613	0.6613	0.7022	0.41031
F	1	0.0112	0.0112	0.0119	0.91387
G	1	1.7113	1.7113	1.8173	0.19023

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	5.7800	5.7800	6.1381	0.02066 *
B	1	0.1800	0.1800	0.1912	0.66587
C	1	0.1250	0.1250	0.1327	0.71879
D	1	2.5312	2.5312	2.6881	0.11415
E	1	0.6613	0.6613	0.7022	0.41031
F	1	0.0112	0.0112	0.0119	0.91387
G	1	1.7113	1.7113	1.8173	0.19023

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	5.7800	5.7800	6.1381	0.02066 *
B	1	0.1800	0.1800	0.1912	0.66587
C	1	0.1250	0.1250	0.1327	0.71879
D	1	2.5312	2.5312	2.6881	0.11415
E	1	0.6613	0.6613	0.7022	0.41031
F	1	0.0112	0.0112	0.0119	0.91387
G	1	1.7113	1.7113	1.8173	0.19023

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

```

$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept)  2.2750     0.48520  4.6888 9.162e-05 ***
A0           -0.8500     0.34309 -2.4775  0.02066 *
A1            0.0000     0.00000
B0            0.1500     0.34309  0.4372  0.66587
B1            0.0000     0.00000
C0           -0.1250     0.34309 -0.3643  0.71879
C1            0.0000     0.00000
D0            0.5625     0.34309  1.6395  0.11415
D1            0.0000     0.00000
E0           -0.2875     0.34309 -0.8380  0.41031
E1            0.0000     0.00000
F0            0.0375     0.34309  0.1093  0.91387
F1            0.0000     0.00000
G0            0.4625     0.34309  1.3481  0.19023
G1            0.0000     0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

(154) MODEL

```
GLM(log(S) ~ A + B + C + D + E + F + G, v2p642) # OK
```

Warning in sqrt(diag(bVar)): NaNs produced

\$ANOVA

```

Response : log(S)
      Df Sum Sq Mean Sq F value Pr(>F)
MODEL      7 266.43   38.062
RESIDUALS  24   0.00    0.000
CORRECTED TOTAL 31 266.43

```

\$`Type I`

```

      Df Sum Sq Mean Sq      F value Pr(>F)
A   1    1.511    1.511 -3.3064e+14      1
B   1    0.600    0.600 -1.3137e+14      1
C   1    0.284    0.284 -6.2177e+13      1
D   1    0.384    0.384 -8.3917e+13      1
E   1    0.741    0.741 -1.6223e+14      1
F   1 261.783 261.783 -5.7278e+16      1
G   1    1.127    1.127 -2.4665e+14      1

```

\$`Type II`

```

      Df Sum Sq Mean Sq      F value Pr(>F)
A   1    1.511    1.511 -3.3064e+14      1
B   1    0.600    0.600 -1.3137e+14      1

```

C	1	0.284	0.284	-6.2177e+13	1
D	1	0.384	0.384	-8.3917e+13	1
E	1	0.741	0.741	-1.6223e+14	1
F	1	261.783	261.783	-5.7278e+16	1
G	1	1.127	1.127	-2.4665e+14	1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	1.511	1.511	-3.3064e+14	1
B	1	0.600	0.600	-1.3137e+14	1
C	1	0.284	0.284	-6.2177e+13	1
D	1	0.384	0.384	-8.3917e+13	1
E	1	0.741	0.741	-1.6223e+14	1
F	1	261.783	261.783	-5.7278e+16	1
G	1	1.127	1.127	-2.4665e+14	1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	0.2218			
A0	0.4346			
A1	0.0000		0	
B0	-0.2740			
B1	0.0000		0	
C0	0.1885			
C1	0.0000		0	
D0	-0.2190			
D1	0.0000		0	
E0	0.3044			
E1	0.0000		0	
F0	-5.7204			
F1	0.0000		0	
G0	0.3754			
G1	0.0000		0	

## 9.11 Chapter 19

### 9.11.1 p700

(155) MODEL

```
v2p700 = read.table("C:/G/Rt/Kemp/v2p700.txt", head=TRUE)
v2p700 = af(v2p700, 2:5)
GLM(Y ~ P + S + T + C, v2p700) # OK
```

\$ANOVA

Response : Y



	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	12	378.80	31.5670	57.256	0.003319 **
RESIDUALS	3	1.65	0.5513		
CORRECTED TOTAL	15	380.46			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
P	3	53.888	17.963	32.580	0.008646 **
S	3	154.508	51.503	93.414	0.001845 **
T	3	149.848	49.949	90.597	0.001930 **
C	3	20.561	6.854	12.431	0.033708 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
P	2	2.220	1.110	2.0133	0.278974
S	3	111.966	37.322	67.6941	0.002969 **
T	3	161.828	53.943	97.8403	0.001722 **
C	3	20.561	6.854	12.4311	0.033708 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
P	2	2.220	1.110	2.0133	0.278974
S	3	111.966	37.322	67.6941	0.002969 **
T	3	161.828	53.943	97.8403	0.001722 **
C	3	20.561	6.854	12.4311	0.033708 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	14.675	0.76085	19.2875	0.0003044 ***
P1	4.670	0.66413	7.0318	0.0059092 **
P2	-0.600	0.52504	-1.1428	0.3360714
P3	0.450	0.52504	0.8571	0.4544117
P4	0.000	0.00000		
S1	2.860	0.55067	5.1937	0.0138648 *
S2	3.595	0.55067	6.5285	0.0073033 **
S3	-3.455	0.55067	-6.2742	0.0081740 **
S4	0.000	0.00000		
T1	5.650	0.55067	10.2603	0.0019739 **
T2	6.255	0.55067	11.3590	0.0014638 **

```

T3          -1.285      0.55067 -2.3335 0.1018191
T4           0.000      0.00000
C0           0.000      0.00000
C1           2.800      0.66413  4.2161 0.0243844 *
C2           0.620      0.66413  0.9336 0.4193997
C3          -1.140      0.66413 -1.7165 0.1845672
C4           0.000      0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

### 9.11.2 p703

(156) MODEL

```

v2p703 = read.table("C:/G/Rt/Kemp/v2p703.txt", head=TRUE)
v2p703$C = ifelse(v2p703$C == 0, 4, v2p703$C)
v2p703 = af(v2p703, 2:5)
GLM(Y ~ P + S + T + C, v2p703) # OK

```

\$ANOVA

Response : Y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	13	385.18	29.6293	21.766	0.0005673 ***
RESIDUALS	6	8.17	1.3613		
CORRECTED TOTAL	19	393.35			

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
P	4	56.408	14.102	10.3596	0.0073255 **
S	3	119.260	39.753	29.2036	0.0005620 ***
T	3	190.430	63.477	46.6312	0.0001498 ***
C	3	19.083	6.361	4.6728	0.0518237 .

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
P	4	52.288	13.072	9.6028	0.0088641 **
S	3	167.414	55.805	40.9952	0.0002163 ***
T	3	190.430	63.477	46.6312	0.0001498 ***
C	3	19.083	6.361	4.6728	0.0518237 .

```

---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
P	4	52.287	13.072	9.6028	0.0088641 **
S	3	167.414	55.805	40.9952	0.0002163 ***
T	3	190.430	63.477	46.6312	0.0001498 ***
C	3	19.083	6.361	4.6728	0.0518237 .

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	14.2042	1.02435	13.8665	8.759e-06 ***
P1	4.8875	0.96740	5.0522	0.0023285 **
P2	-0.7000	0.82500	-0.8485	0.4287138
P3	0.3500	0.82500	0.4242	0.6861791
P4	-0.1000	0.82500	-0.1212	0.9074805
P5	0.0000	0.00000		
S1	3.4500	0.75312	4.5810	0.0037667 **
S2	3.4250	0.75312	4.5478	0.0039011 **
S3	-3.7083	0.75312	-4.9240	0.0026462 **
S4	0.0000	0.00000		
T1	5.5667	0.75312	7.3915	0.0003148 ***
T2	6.4250	0.75312	8.5312	0.0001422 ***
T3	-0.5250	0.75312	-0.6971	0.5118309
T4	0.0000	0.00000		
C1	2.6750	0.82500	3.2424	0.0176331 *
C2	0.8750	0.82500	1.0606	0.3296846
C3	0.0000	0.82500	0.0000	1.0000000
C4	0.0000	0.00000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 10 Lawson - DAE with SAS

### Reference

- Lawson J. Design and Analysis of Experiments with SAS. Taylor and Francis Group. 2010.

Loading required package: daewr

Registered S3 method overwritten by 'DoE.base':

```
method          from  
factorize.factor conf.design
```

```
require(daewr)
```

### 10.1 Chapter 2

#### 10.1.1 p22

(157) MODEL

```
GLM(height ~ time, bread) # OK
```

\$ANOVA

Response : height

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	2	21.573	10.7865	4.6022	0.042 *
RESIDUALS	9	21.094	2.3438		
CORRECTED TOTAL	11	42.667			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
time	2	21.573	10.787	4.6022	0.042 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
time	2	21.573	10.787	4.6022	0.042 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
--	----	--------	---------	---------	--------

```

time 2 21.573 10.787 4.6022 0.042 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept)  8.3125     0.76547 10.8594 1.794e-06 ***
time35       -2.8750     1.08253 -2.6558 0.02623 *
time40       -0.0625     1.08253 -0.0577 0.95522
time45        0.0000     0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

### 10.1.2 p32

(158) MODEL

```
GLM(height^(1 - 1.294869) ~ time, bread) # OK
```

```

$ANOVA
Response : height^(1 - 1.294869)
      Df    Sum Sq  Mean Sq F value Pr(>F)
MODEL      2 0.0130560 0.0065280  5.9356 0.02271 *
RESIDUALS   9 0.0098983 0.0010998
CORRECTED TOTAL 11 0.0229544
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type I`
      Df    Sum Sq  Mean Sq F value Pr(>F)
time 2 0.013056 0.006528  5.9356 0.02271 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type II`
      Df    Sum Sq  Mean Sq F value Pr(>F)
time 2 0.013056 0.006528  5.9356 0.02271 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
      Df    Sum Sq  Mean Sq F value Pr(>F)
time 2 0.013056 0.006528  5.9356 0.02271 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.53776    0.016582 32.4307 1.239e-10 ***
time35       0.07182    0.023450  3.0626  0.01351 *
time40       0.00385    0.023450  0.1643  0.87315
time45       0.00000    0.000000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

### 10.1.3 p42

(159) MODEL

```
GLM(yield ~ treat, sugarbeet) # OK
```

```

$ANOVA
Response : yield
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      3 291.00   97.002    45.9 1.718e-07 ***
RESIDUALS  14  29.59    2.113
CORRECTED TOTAL 17 320.59
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
treat  3    291   97.002    45.9 1.718e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
treat  3    291   97.002    45.9 1.718e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
treat  3    291   97.002    45.9 1.718e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept)    48.7      0.65013  74.9085 < 2.2e-16 ***
treatA         -10.0      0.97519 -10.2544 6.837e-08 ***

```

```

treatB      -3.7      0.97519  -3.7941  0.001974 **
treatC       0.1      0.91942   0.1088  0.914933
treatD       0.0      0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 10.2 Chapter 3

### 10.2.1 p63

(160) MODEL

```
GLM(CO ~ Eth + Ratio + Eth:Ratio, COdata) # OK
```

```

$ANOVA
Response : CO
          Df Sum Sq Mean Sq F value    Pr(>F)
MODEL          8 1654.0  206.750   40.016 3.861e-06 ***
RESIDUALS       9   46.5    5.167
CORRECTED TOTAL 17 1700.5
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type I`
          Df Sum Sq Mean Sq F value    Pr(>F)
Eth          2   324   162.0   31.355 8.790e-05 ***
Ratio        2   652   326.0   63.097 5.067e-06 ***
Eth:Ratio    4   678   169.5   32.806 2.240e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type II`
          Df Sum Sq Mean Sq F value    Pr(>F)
Eth          2   324   162.0   31.355 8.790e-05 ***
Ratio        2   652   326.0   63.097 5.067e-06 ***
Eth:Ratio    4   678   169.5   32.806 2.240e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type III`
          Df Sum Sq Mean Sq F value    Pr(>F)
Eth          2   324   162.0   31.355 8.790e-05 ***
Ratio        2   652   326.0   63.097 5.067e-06 ***
Eth:Ratio    4   678   169.5   32.806 2.240e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$Parameter
      Estimate Std. Error  t value Pr(>|t|)
(Intercept)      59.0      1.6073  36.7081 4.094e-11 ***
Eth0.1           8.0      2.2730   3.5195 0.0065202 **
Eth0.2           8.5      2.2730   3.7395 0.0046291 **
Eth0.3           0.0      0.0000
Ratio14          33.0      2.2730  14.5181 1.498e-07 ***
Ratio15          17.5      2.2730   7.6990 3.003e-05 ***
Ratio16           0.0      0.0000
Eth0.1:Ratio14   -36.0      3.2146 -11.1991 1.384e-06 ***
Eth0.1:Ratio15   -15.0      3.2146  -4.6663 0.0011747 **
Eth0.1:Ratio16    0.0      0.0000
Eth0.2:Ratio14   -21.0      3.2146  -6.5328 0.0001073 ***
Eth0.2:Ratio15    -4.5      3.2146  -1.3999 0.1950620
Eth0.2:Ratio16    0.0      0.0000
Eth0.3:Ratio14    0.0      0.0000
Eth0.3:Ratio15    0.0      0.0000
Eth0.3:Ratio16    0.0      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

(161) MODEL

```
GLM(CO ~ Ratio + Eth + Ratio:Eth, COdata) # OK
```

```

$ANOVA
Response : CO
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      8 1654.0  206.750   40.016 3.861e-06 ***
RESIDUALS   9   46.5    5.167
CORRECTED TOTAL 17 1700.5
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
Ratio    2   652   326.0   63.097 5.067e-06 ***
Eth       2   324   162.0   31.355 8.790e-05 ***
Ratio:Eth 4   678   169.5   32.806 2.240e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
Ratio    2   652   326.0   63.097 5.067e-06 ***
Eth       2   324   162.0   31.355 8.790e-05 ***

```



```

Ratio:Eth  4      678   169.5  32.806 2.240e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
Ratio    2     652   326.0   63.097 5.067e-06 ***
Eth       2     324   162.0   31.355 8.790e-05 ***
Ratio:Eth  4     678   169.5   32.806 2.240e-05 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept)    59.0      1.6073  36.7081 4.094e-11 ***
Ratio14         33.0      2.2730  14.5181 1.498e-07 ***
Ratio15         17.5      2.2730   7.6990 3.003e-05 ***
Ratio16          0.0      0.0000   0.0000 1.000e+00
Eth0.1           8.0      2.2730   3.5195 0.0065202 **
Eth0.2           8.5      2.2730   3.7395 0.0046291 **
Eth0.3           0.0      0.0000   0.0000 1.000e+00
Ratio14:Eth0.1  -36.0      3.2146 -11.1991 1.384e-06 ***
Ratio14:Eth0.2  -21.0      3.2146  -6.5328 0.0001073 ***
Ratio14:Eth0.3   0.0      0.0000   0.0000 1.000e+00
Ratio15:Eth0.1  -15.0      3.2146  -4.6663 0.0011747 **
Ratio15:Eth0.2   -4.5      3.2146  -1.3999 0.1950620
Ratio15:Eth0.3   0.0      0.0000   0.0000 1.000e+00
Ratio16:Eth0.1   0.0      0.0000   0.0000 1.000e+00
Ratio16:Eth0.2   0.0      0.0000   0.0000 1.000e+00
Ratio16:Eth0.3   0.0      0.0000   0.0000 1.000e+00
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

### 10.2.2 p74

(162) MODEL

```
GLM(CO ~ Eth + Ratio + Eth:Ratio, COdata[-18,]) # OK
```

\$ANOVA

Response : CO

```

      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      8 1423.0  177.879   31.978 2.749e-05 ***
RESIDUALS   8   44.5    5.563
CORRECTED TOTAL 16 1467.5
---

```

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Eth	2	472.66	236.33	42.486	5.482e-05 ***
Ratio	2	395.33	197.66	35.535	0.0001048 ***
Eth:Ratio	4	555.04	138.76	24.945	0.0001427 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Eth	2	398.26	199.13	35.799	0.0001020 ***
Ratio	2	395.33	197.66	35.535	0.0001048 ***
Eth:Ratio	4	555.04	138.76	24.945	0.0001427 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Eth	2	319.45	159.73	28.715	0.0002235 ***
Ratio	2	511.45	255.73	45.973	4.105e-05 ***
Eth:Ratio	4	555.04	138.76	24.945	0.0001427 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	60.0	2.3585	25.4399	6.108e-09 ***
Eth0.1	7.0	2.8886	2.4234	0.0416315 *
Eth0.2	7.5	2.8886	2.5965	0.0317925 *
Eth0.3	0.0	0.0000		
Ratio14	32.0	2.8886	11.0782	3.933e-06 ***
Ratio15	16.5	2.8886	5.7122	0.0004480 ***
Ratio16	0.0	0.0000		
Eth0.1:Ratio14	-35.0	3.7291	-9.3856	1.360e-05 ***
Eth0.1:Ratio15	-14.0	3.7291	-3.7542	0.0055901 **
Eth0.1:Ratio16	0.0	0.0000		
Eth0.2:Ratio14	-20.0	3.7291	-5.3632	0.0006751 ***
Eth0.2:Ratio15	-3.5	3.7291	-0.9386	0.3754235
Eth0.2:Ratio16	0.0	0.0000		
Eth0.3:Ratio14	0.0	0.0000		
Eth0.3:Ratio15	0.0	0.0000		
Eth0.3:Ratio16	0.0	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

### 10.2.3 p91

(163) MODEL

```
volt$XA = (as.numeric(as.character(volt$A)) - 27)/5
volt$XB = (as.numeric(as.character(volt$B)) - 2.75)/2.25
volt$XC = (as.numeric(as.character(volt$C)) - 2.75)/2.25
GLM(y ~ XA + XB + XC + XA:XB + XA:XC + XB:XC + XA:XB:XC, volt) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	7	8843.4	1263.35	3.8686	0.0385 *
RESIDUALS	8	2612.5	326.56		
CORRECTED TOTAL	15	11455.9			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
XA	1	4522.6	4522.6	13.8490	0.005859 **
XB	1	14.1	14.1	0.0431	0.840793
XC	1	473.1	473.1	1.4486	0.263154
XA:XB	1	715.6	715.6	2.1912	0.177071
XA:XC	1	2525.1	2525.1	7.7322	0.023899 *
XB:XC	1	52.6	52.6	0.1610	0.698780
XA:XB:XC	1	540.6	540.6	1.6553	0.234218

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
XA	1	4522.6	4522.6	13.8490	0.005859 **
XB	1	14.1	14.1	0.0431	0.840793
XC	1	473.1	473.1	1.4486	0.263154
XA:XB	1	715.6	715.6	2.1912	0.177071
XA:XC	1	2525.1	2525.1	7.7322	0.023899 *
XB:XC	1	52.6	52.6	0.1610	0.698780
XA:XB:XC	1	540.6	540.6	1.6553	0.234218

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
XA	1	4522.6	4522.6	13.8490	0.005859 **
XB	1	14.1	14.1	0.0431	0.840793
XC	1	473.1	473.1	1.4486	0.263154

```

XA:XB      1  715.6   715.6  2.1912 0.177071
XA:XC      1 2525.1  2525.1  7.7322 0.023899 *
XB:XC      1   52.6   52.6  0.1610 0.698780
XA:XB:XC   1  540.6   540.6  1.6553 0.234218
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$Parameter
      Estimate Std. Error  t value  Pr(>|t|)
(Intercept)  668.56      4.5178 147.9854 4.885e-15 ***
XA           -16.81      4.5178  -3.7214 0.005859 **
XB              0.94      4.5178   0.2075 0.840793
XC              5.44      4.5178   1.2036 0.263154
XA:XB         -6.69      4.5178  -1.4803 0.177071
XA:XC         12.56      4.5178   2.7807 0.023899 *
XB:XC          1.81      4.5178   0.4012 0.698780
XA:XB:XC      -5.81      4.5178  -1.2866 0.234218
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

#### 10.2.4 p97

(164) MODEL

```

chem2 = af(chem, c("A","B","C","D"))
GLM(y ~ A*B*C*D, chem2) # OK

```

```

$ANOVA
Response : y
      Df Sum Sq Mean Sq F value Pr(>F)
MODEL      15 6369.4   424.63
RESIDUALS    0    0.0
CORRECTED TOTAL 15 6369.4

```

```

$`Type I`
      Df Sum Sq Mean Sq F value Pr(>F)
A         1  637.6   637.6
B         1 5076.6  5076.6
A:B        1  451.6   451.6
C          1    0.6     0.6
A:C         1   10.6    10.6
B:C         1    1.6     1.6
A:B:C       1    0.6     0.6
D           1    7.6     7.6
A:D         1   68.1    68.1
B:D         1    0.1     0.1

```

A:B:D	1	7.6	7.6
C:D	1	7.6	7.6
A:C:D	1	95.1	95.1
B:C:D	1	3.1	3.1
A:B:C:D	1	1.6	1.6

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	637.6	637.6		
B	1	5076.6	5076.6		
A:B	1	451.6	451.6		
C	1	0.6	0.6		
A:C	1	10.6	10.6		
B:C	1	1.6	1.6		
A:B:C	1	0.6	0.6		
D	1	7.6	7.6		
A:D	1	68.1	68.1		
B:D	1	0.1	0.1		
A:B:D	1	7.6	7.6		
C:D	1	7.6	7.6		
A:C:D	1	95.1	95.1		
B:C:D	1	3.1	3.1		
A:B:C:D	1	1.6	1.6		

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	637.6	637.6		
B	1	5076.6	5076.6		
A:B	1	451.6	451.6		
C	1	0.6	0.6		
A:C	1	10.6	10.6		
B:C	1	1.6	1.6		
A:B:C	1	0.6	0.6		
D	1	7.6	7.6		
A:D	1	68.1	68.1		
B:D	1	0.1	0.1		
A:B:D	1	7.6	7.6		
C:D	1	7.6	7.6		
A:C:D	1	95.1	95.1		
B:C:D	1	3.1	3.1		
A:B:C:D	1	1.6	1.6		

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	93			
A-1	4			
A1	0			
B-1	-45			

B1	0
A1:B1	-19
A1:B-1	0
A-1:B1	0
A-1:B-1	0
C-1	-5
C1	0
A1:C1	-7
A1:C-1	0
A-1:C1	0
A-1:C-1	0
B1:C1	0
B1:C-1	0
B-1:C1	0
B-1:C-1	0
A1:B1:C1	1
A1:B1:C-1	0
A1:B-1:C1	0
A1:B-1:C-1	0
A-1:B1:C1	0
A-1:B1:C-1	0
A-1:B-1:C1	0
A-1:B-1:C-1	0
D-1	-2
D1	0
A1:D1	0
A1:D-1	0
A-1:D1	0
A-1:D-1	0
B1:D1	3
B1:D-1	0
B-1:D1	0
B-1:D-1	0
A1:B1:D1	-3
A1:B1:D-1	0
A1:B-1:D1	0
A1:B-1:D-1	0
A-1:B1:D1	0
A-1:B1:D-1	0
A-1:B-1:D1	0
A-1:B-1:D-1	0
C1:D1	-12
C1:D-1	0
C-1:D1	0
C-1:D-1	0
A1:C1:D1	22
A1:C1:D-1	0
A1:C-1:D1	0

A1:C-1:D-1	0
A-1:C1:D1	0
A-1:C1:D-1	0
A-1:C-1:D1	0
A-1:C-1:D-1	0
B1:C1:D1	-1
B1:C1:D-1	0
B1:C-1:D1	0
B1:C-1:D-1	0
B-1:C1:D1	0
B-1:C1:D-1	0
B-1:C-1:D1	0
B-1:C-1:D-1	0
A1:B1:C1:D1	-5
A1:B1:C1:D-1	0
A1:B1:C-1:D1	0
A1:B1:C-1:D-1	0
A1:B-1:C1:D1	0
A1:B-1:C1:D-1	0
A1:B-1:C-1:D1	0
A1:B-1:C-1:D-1	0
A-1:B1:C1:D1	0
A-1:B1:C1:D-1	0
A-1:B1:C-1:D1	0
A-1:B1:C-1:D-1	0
A-1:B-1:C1:D1	0
A-1:B-1:C1:D-1	0
A-1:B-1:C-1:D1	0
A-1:B-1:C-1:D-1	0

### 10.2.5 p104

(165) MODEL

```
GLM(y ~ A*B*C*D, BoxM) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	15	207.1	13.807		
RESIDUALS	0	0.0			
CORRECTED TOTAL	15	207.1			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	2.560	2.560		

B	1	71.234	71.234
A:B	1	3.312	3.312
C	1	55.056	55.056
A:C	1	24.800	24.800
B:C	1	2.560	2.560
A:B:C	1	5.760	5.760
D	1	4.080	4.080
A:D	1	1.346	1.346
B:D	1	5.570	5.570
A:B:D	1	2.074	2.074
C:D	1	8.880	8.880
A:C:D	1	0.640	0.640
B:C:D	1	9.986	9.986
A:B:C:D	1	9.242	9.242

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	2.560	2.560		
B	1	71.234	71.234		
A:B	1	3.312	3.312		
C	1	55.056	55.056		
A:C	1	24.800	24.800		
B:C	1	2.560	2.560		
A:B:C	1	5.760	5.760		
D	1	4.080	4.080		
A:D	1	1.346	1.346		
B:D	1	5.570	5.570		
A:B:D	1	2.074	2.074		
C:D	1	8.880	8.880		
A:C:D	1	0.640	0.640		
B:C:D	1	9.986	9.986		
A:B:C:D	1	9.242	9.242		

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	2.560	2.560		
B	1	71.234	71.234		
A:B	1	3.312	3.312		
C	1	55.056	55.056		
A:C	1	24.800	24.800		
B:C	1	2.560	2.560		
A:B:C	1	5.760	5.760		
D	1	4.080	4.080		
A:D	1	1.346	1.346		
B:D	1	5.570	5.570		
A:B:D	1	2.074	2.074		
C:D	1	8.880	8.880		
A:C:D	1	0.640	0.640		



```
B:C:D    1  9.986  9.986
A:B:C:D  1  9.242  9.242
```

```
$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept)  48.245
A             -0.400
B            -2.110
A:B           0.455
C             1.855
A:C          -1.245
B:C          -0.400
A:B:C         0.600
D             0.505
A:D          -0.290
B:D          -0.590
A:B:D         0.360
C:D           0.745
A:C:D         0.200
B:C:D        -0.790
A:B:C:D       0.760
```

### 10.3 Chapter 4

#### 10.3.1 p122

(166) MODEL

```
GLM(rate ~ rat + dose, drug) # OK
```

```
$ANOVA
```

```
Response : rate
```

```
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      13  2.12867  0.163744   19.613 1.59e-12 ***
RESIDUALS    36  0.30055  0.008349
CORRECTED TOTAL 49  2.42922
```

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
```

```
      Df Sum Sq Mean Sq F value    Pr(>F)
rat      9 1.66846  0.18538   22.205 3.749e-12 ***
dose     4  0.46021  0.11505   13.781 6.535e-07 ***
```

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
rat    9 1.66846 0.18538  22.205 3.749e-12 ***
dose   4 0.46021 0.11505  13.781 6.535e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
rat    9 1.66846 0.18538  22.205 3.749e-12 ***
dose   4 0.46021 0.11505  13.781 6.535e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.0578    0.048349 21.8784 < 2.2e-16 ***
rat1         -0.4160    0.057788 -7.1987 1.804e-08 ***
rat2         -0.4300    0.057788 -7.4410 8.740e-09 ***
rat3         -0.4040    0.057788 -6.9911 3.373e-08 ***
rat4         -0.3000    0.057788 -5.1914 8.362e-06 ***
rat5         -0.1340    0.057788 -2.3188 0.0261960 *
rat6         -0.2880    0.057788 -4.9837 1.579e-05 ***
rat7         -0.2140    0.057788 -3.7032 0.0007098 ***
rat8          0.0240    0.057788  0.4153 0.6803798
rat9          0.0840    0.057788  1.4536 0.1547238
rat10         0.0000    0.000000
dose0        -0.0860    0.040862 -2.1046 0.0423697 *
dose0.5       0.0840    0.040862  2.0557 0.0471211 *
dose1         0.1640    0.040862  4.0135 0.0002899 ***
dose1.5       0.1590    0.040862  3.8911 0.0004137 ***
dose2         0.0000    0.000000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

### 10.3.2 p127

(167) MODEL

```
GLM(y ~ block + treat + strain + treat:strain, bha) # OK
```

```
$ANOVA
Response : y
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL    8 543.22  67.902  26.203 0.0001507 ***
RESIDUALS 7  18.14   2.591
```

CORRECTED TOTAL 15 561.36

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	1	47.61	47.61	18.3721	0.003627 **
treat	1	422.30	422.30	162.9613	4.194e-06 ***
strain	3	32.96	10.99	4.2399	0.052741 .
treat:strain	3	40.34	13.45	5.1892	0.033685 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	1	47.61	47.61	18.3721	0.003627 **
treat	1	422.30	422.30	162.9613	4.194e-06 ***
strain	3	32.96	10.99	4.2399	0.052741 .
treat:strain	3	40.34	13.45	5.1892	0.033685 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
block	1	47.61	47.61	18.3721	0.003627 **
treat	1	422.30	422.30	162.9613	4.194e-06 ***
strain	3	32.96	10.99	4.2399	0.052741 .
treat:strain	3	40.34	13.45	5.1892	0.033685 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	13.875	1.2073	11.4922	8.495e-06 ***
block1	3.450	0.8049	4.2863	0.003627 **
block2	0.000	0.0000		
treatcontrol	-15.200	1.6098	-9.4422	3.119e-05 ***
treattreated	0.000	0.0000		
strain1290la	0.550	1.6098	0.3417	0.742635
strainA/J	2.100	1.6098	1.3045	0.233308
strainBALB/c	7.450	1.6098	4.6279	0.002404 **
strainNIH	0.000	0.0000		
treatcontrol:strainA/J	4.550	2.2766	1.9986	0.085796 .
treatcontrol:strainNIH	8.550	2.2766	3.7556	0.007116 **
treatcontrol:strain1290la	6.600	2.2766	2.8991	0.023016 *
treatcontrol:strainBALB/c	0.000	0.0000		
treattreated:strainA/J	0.000	0.0000		
treattreated:strainNIH	0.000	0.0000		

```
treattreated:strain12901a    0.000    0.0000
treattreated:strainBALB/c    0.000    0.0000
```

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

### 10.3.3 p129

(168) MODEL

```
GLM(cdistance ~ id + teehgt, rcb) # OK
```

```
$ANOVA
```

```
Response : cdistance
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	10	126465	12646.5	161.72	< 2.2e-16 ***
RESIDUALS	124	9697	78.2		
CORRECTED TOTAL	134	136162			

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
id	8	124741	15593	199.394	< 2.2e-16 ***
teehgt	2	1724	862	11.023	3.926e-05 ***

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
id	8	124741	15593	199.394	< 2.2e-16 ***
teehgt	2	1724	862	11.023	3.926e-05 ***

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
id	8	124741	15593	199.394	< 2.2e-16 ***
teehgt	2	1724	862	11.023	3.926e-05 ***

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
```

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	240.440	2.5243	95.2517	< 2.2e-16 ***
id1	-92.907	3.2290	-28.7722	< 2.2e-16 ***
id2	-57.860	3.2290	-17.9186	< 2.2e-16 ***

```

id3          -92.907      3.2290 -28.7722 < 2.2e-16 ***
id4          -60.360      3.2290 -18.6928 < 2.2e-16 ***
id5          -22.267      3.2290  -6.8957 2.422e-10 ***
id6          -92.860      3.2290 -28.7577 < 2.2e-16 ***
id7          -66.720      3.2290 -20.6625 < 2.2e-16 ***
id8          -59.540      3.2290 -18.4389 < 2.2e-16 ***
id9           0.000      0.0000
teehgt1      -8.380      1.8643  -4.4950 1.575e-05 ***
teehgt2      -2.000      1.8643  -1.0728  0.2854
teehgt3       0.000      0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

### 10.3.4 p136

(169) MODEL

```
GLM(AUC ~ Subject + Period + Treat, bioeqv) # OK
```

\$ANOVA

Response : AUC

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	6	174461	29077	0.1315	0.9774
RESIDUALS	2	442158	221079		
CORRECTED TOTAL	8	616618			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	2	114264	57132	0.2584	0.7946
Period	2	45196	22598	0.1022	0.9073
Treat	2	15000	7500	0.0339	0.9672

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	2	114264	57132	0.2584	0.7946
Period	2	45196	22598	0.1022	0.9073
Treat	2	15000	7500	0.0339	0.9672

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	2	114264	57132	0.2584	0.7946
Period	2	45196	22598	0.1022	0.9073
Treat	2	15000	7500	0.0339	0.9672

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
--	----------	------------	---------	----------

```

(Intercept) 1352.56      414.67  3.2618  0.08252 .
Subject1    -276.00      383.91 -0.7189  0.54684
Subject2    -138.33      383.91 -0.3603  0.75310
Subject3       0.00       0.00
Period1     -171.00      383.91 -0.4454  0.69959
Period2     -111.33      383.91 -0.2900  0.79912
Period3       0.00       0.00
TreatA       78.33      383.91  0.2040  0.85720
TreatB      -14.67      383.91 -0.0382  0.97300
TreatC       0.00       0.00
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 10.4 Chapter 5

### 10.4.1 p152

(170) MODEL

```
GLM(conc ~ lab, Apo) # OK
```

```

$ANOVA
Response : conc
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      3 0.092233 0.0307444  42.107 4.009e-10 ***
RESIDUALS  26 0.018984 0.0007302
CORRECTED TOTAL 29 0.111217
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
lab    3 0.092233 0.030744  42.107 4.009e-10 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
lab    3 0.092233 0.030744  42.107 4.009e-10 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
lab    3 0.092233 0.030744  42.107 4.009e-10 ***
---

```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
```

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	1.16425	0.0095535	121.8661	< 2.2e-16 ***
labA	0.02661	0.0139849	1.9026	0.06823 .
labB	-0.00237	0.0135107	-0.1758	0.86182
labC	-0.12111	0.0139849	-8.6598	3.878e-09 ***
labD	0.00000	0.0000000		

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

## 10.4.2 p181

(171) MODEL

```
GLM(residue ~ form + tech + form:tech + plot:form:tech, pesticide) # OK
```

```
$ANOVA
```

```
Response : residue
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	7	0.036857	0.0052653	11.804	0.001187 **
RESIDUALS	8	0.003569	0.0004461		
CORRECTED TOTAL	15	0.040426			

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
form	1	0.000018	0.000018	0.0405	0.84554
tech	1	0.032310	0.032310	72.4339	2.789e-05 ***
form:tech	1	0.002186	0.002186	4.8997	0.05776 .
form:tech:plot	4	0.002344	0.000586	1.3136	0.34317

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
form	1	0.000018	0.000018	0.0405	0.84554
tech	1	0.032310	0.032310	72.4339	2.789e-05 ***
form:tech	1	0.002186	0.002186	4.8997	0.05776 .
form:tech:plot	4	0.002344	0.000586	1.3136	0.34317

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
```

```

      Df    Sum Sq Mean Sq F value    Pr(>F)
form      1 0.000018 0.000018  0.0405  0.84554
tech      1 0.032310 0.032310 72.4339 2.789e-05 ***
form:tech  1 0.002186 0.002186  4.8997  0.05776 .
form:tech:plot 4 0.002344 0.000586  1.3136  0.34317
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

\$Parameter

```

      Estimate Std. Error t value Pr(>|t|)
(Intercept)      0.3410    0.014934 22.8334 1.435e-08 ***
formA              0.0225    0.021120  1.0653  0.31782
formB              0.0000    0.000000
tech1             -0.0470    0.021120 -2.2254  0.05671 .
tech2              0.0000    0.000000
formA:tech1       -0.0390    0.029868 -1.3057  0.22794
formA:tech2        0.0000    0.000000
formB:tech1        0.0000    0.000000
formB:tech2        0.0000    0.000000
formA:tech1:plot1 -0.0330    0.021120 -1.5625  0.15680
formA:tech1:plot2  0.0000    0.000000
formA:tech2:plot1  0.0215    0.021120  1.0180  0.33848
formA:tech2:plot2  0.0000    0.000000
formB:tech1:plot1 -0.0235    0.021120 -1.1127  0.29816
formB:tech1:plot2  0.0000    0.000000
formB:tech2:plot1  0.0155    0.021120  0.7339  0.48396
formB:tech2:plot2  0.0000    0.000000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 10.5 Chapter 7

### 10.5.1 p260

(172) MODEL

```
GLM(score ~ recipe + panelist, taste) # OK
```

\$ANOVA

Response : score

```

      Df Sum Sq Mean Sq F value Pr(>F)
MODEL      14 28.458  2.03274    2.661 0.0719 .
RESIDUALS     9  6.875  0.76389
CORRECTED TOTAL 23 35.333
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```



```
$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
recipe    3 21.0000    7.000   9.1636 0.004246 **
panelist 11  7.4583    0.678   0.8876 0.581099
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
      Df Sum Sq Mean Sq F value    Pr(>F)
recipe    3  9.1250  3.04167   3.9818 0.04649 *
panelist 11  7.4583  0.67803   0.8876 0.58110
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
recipe    3  9.1250  3.04167   3.9818 0.04649 *
panelist 11  7.4583  0.67803   0.8876 0.58110
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
      Estimate Std. Error t value    Pr(>|t|)
(Intercept)   4.5000     0.69096   6.5126 0.0001098 ***
recipeA        0.6250     0.61802   1.0113 0.3382874
recipeB        1.3750     0.61802   2.2249 0.0531409 .
recipeC        2.0000     0.61802   3.2362 0.0102213 *
recipeD        0.0000     0.00000
panelist1      -0.5000     0.97717  -0.5117 0.6211912
panelist2       0.6875     0.92702   0.7416 0.4772232
panelist3      -0.3125     0.92702  -0.3371 0.7437697
panelist4       0.3125     0.92702   0.3371 0.7437697
panelist5      -0.1875     0.92702  -0.2023 0.8442116
panelist6       1.5000     0.87401   1.7162 0.1202534
panelist7       1.0000     0.97717   1.0234 0.3328547
panelist8       0.6875     0.92702   0.7416 0.4772232
panelist9      -0.3125     0.92702  -0.3371 0.7437697
panelist10      0.8125     0.92702   0.8765 0.4035670
panelist11      0.3125     0.92702   0.3371 0.7437697
panelist12      0.0000     0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

## 10.5.2 p262

(173) MODEL

```
GLM(pressure ~ Block + Treatment, BPmonitor) # OK
```

```
$ANOVA
```

```
Response : pressure
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	8	321.00	40.125	4.4174	0.1245
RESIDUALS	3	27.25	9.083		
CORRECTED TOTAL	11	348.25			

```
$`Type I`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Block	5	73.75	14.750	1.6239	0.36606
Treatment	3	247.25	82.417	9.0734	0.05149 .

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Block	5	83.25	16.650	1.8330	0.32772
Treatment	3	247.25	82.417	9.0734	0.05149 .

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Block	5	83.25	16.650	1.8330	0.32772
Treatment	3	247.25	82.417	9.0734	0.05149 .

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
```

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	78.00	2.6101	29.8842	8.23e-05 ***
Block1	6.25	3.6912	1.6932	0.18899
Block2	2.75	3.6912	0.7450	0.51032
Block3	9.50	3.6912	2.5737	0.08223 .
Block4	3.50	3.6912	0.9482	0.41298
Block5	2.00	3.0139	0.6636	0.55439
Block6	0.00	0.0000		
TreatmentA	-6.50	3.0139	-2.1567	0.11995
TreatmentB	-13.00	3.0139	-4.3134	0.02295 *
TreatmentC	-6.00	3.0139	-1.9908	0.14057
TreatmentP	0.00	0.0000		

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

### 10.5.3 p276

(174) MODEL

```
GLM(weight ~ Blocks + A + B + C + D + E + F + G + H, Bff) # OK
```

\$ANOVA

Response : weight

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	15	158.37	10.558		
RESIDUALS	0	0.00			
CORRECTED TOTAL	15	158.37			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Blocks	7	30.567	4.367		
A	1	21.879	21.879		
B	1	8.338	8.338		
C	1	6.213	6.213		
D	1	12.870	12.870		
E	1	0.098	0.098		
F	1	1.260	1.260		
G	1	71.868	71.868		
H	1	5.279	5.279		

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Blocks	7	30.567	4.367		
A	1	21.879	21.879		
B	1	8.338	8.338		
C	1	6.213	6.213		
D	1	12.870	12.870		
E	1	0.098	0.098		
F	1	1.260	1.260		
G	1	71.868	71.868		
H	1	5.279	5.279		

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Blocks	7	30.567	4.367		
A	1	21.879	21.879		
B	1	8.338	8.338		
C	1	6.213	6.213		
D	1	12.870	12.870		
E	1	0.098	0.098		
F	1	1.260	1.260		
G	1	71.868	71.868		

H 1 5.279 5.279

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	10.2000			
Blocks1	-3.0350			
Blocks2	0.0900			
Blocks3	-0.9600			
Blocks4	-2.1700			
Blocks5	-0.4600			
Blocks6	-2.5200			
Blocks7	-3.8200			
Blocks8	0.0000			
A-1	-2.3388			
A1	0.0000			
B-1	1.4437			
B1	0.0000			
C-1	-1.2463			
C1	0.0000			
D-1	1.7937			
D1	0.0000			
E-1	-0.1563			
E1	0.0000			
F-1	0.5612			
F1	0.0000			
G-1	-4.2388			
G1	0.0000			
H-1	-1.1488			
H1	0.0000			

## 10.6 Chapter 8

### 10.6.1 p315

(175) MODEL

```
GLM(ys ~ Block + A*B + Block:A*B + C*D + A:C + A:D + B:C + B:D + A:B:C + A:B:D +  
      A:C:D + B:C:D + A:B:C:D, sausage) # OK
```

\$ANOVA

Response : ys

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	19	0.064059	0.0033715	14.134	1.74e-05 ***
RESIDUALS	12	0.002862	0.0002385		
CORRECTED TOTAL	31	0.066922			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
Block	1	0.000903	0.000903	3.7860	0.075482	.
A	1	0.045753	0.045753	191.8035	9.647e-09	***
B	1	0.002628	0.002628	11.0175	0.006119	**
A:B	1	0.001128	0.001128	4.7293	0.050371	.
Block:A:B	3	0.005484	0.001828	7.6638	0.004007	**
C	1	0.003828	0.003828	16.0480	0.001743	**
D	1	0.000528	0.000528	2.2140	0.162566	
C:D	1	0.000253	0.000253	1.0611	0.323272	
A:C	1	0.000153	0.000153	0.6419	0.438593	
A:D	1	0.000903	0.000903	3.7860	0.075482	.
B:C	1	0.000078	0.000078	0.3275	0.577693	
B:D	1	0.000253	0.000253	1.0611	0.323272	
A:B:C	1	0.001378	0.001378	5.7773	0.033299	*
A:B:D	1	0.000703	0.000703	2.9476	0.111680	
A:C:D	1	0.000028	0.000028	0.1179	0.737260	
B:C:D	1	0.000028	0.000028	0.1179	0.737260	
A:B:C:D	1	0.000028	0.000028	0.1179	0.737260	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
Block	1	0.000903	0.000903	3.7860	0.075482	.
A	1	0.045753	0.045753	191.8035	9.647e-09	***
B	1	0.002628	0.002628	11.0175	0.006119	**
A:B	1	0.001128	0.001128	4.7293	0.050371	.
Block:A:B	3	0.005484	0.001828	7.6638	0.004007	**
C	1	0.003828	0.003828	16.0480	0.001743	**
D	1	0.000528	0.000528	2.2140	0.162566	
C:D	1	0.000253	0.000253	1.0611	0.323272	
A:C	1	0.000153	0.000153	0.6419	0.438593	
A:D	1	0.000903	0.000903	3.7860	0.075482	.
B:C	1	0.000078	0.000078	0.3275	0.577693	
B:D	1	0.000253	0.000253	1.0611	0.323272	
A:B:C	1	0.001378	0.001378	5.7773	0.033299	*
A:B:D	1	0.000703	0.000703	2.9476	0.111680	
A:C:D	1	0.000028	0.000028	0.1179	0.737260	
B:C:D	1	0.000028	0.000028	0.1179	0.737260	
A:B:C:D	1	0.000028	0.000028	0.1179	0.737260	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
--	----	--------	---------	---------	--------

Block	1	0.000903	0.000903	3.7860	0.075482	.
A	1	0.045753	0.045753	191.8035	9.647e-09	***
B	1	0.002628	0.002628	11.0175	0.006119	**
A:B	1	0.001128	0.001128	4.7293	0.050371	.
Block:A:B	3	0.005484	0.001828	7.6638	0.004007	**
C	1	0.003828	0.003828	16.0480	0.001743	**
D	1	0.000528	0.000528	2.2140	0.162566	
C:D	1	0.000253	0.000253	1.0611	0.323272	
A:C	1	0.000153	0.000153	0.6419	0.438593	
A:D	1	0.000903	0.000903	3.7860	0.075482	.
B:C	1	0.000078	0.000078	0.3275	0.577693	
B:D	1	0.000253	0.000253	1.0611	0.323272	
A:B:C	1	0.001378	0.001378	5.7773	0.033299	*
A:B:D	1	0.000703	0.000703	2.9476	0.111680	
A:C:D	1	0.000028	0.000028	0.1179	0.737260	
B:C:D	1	0.000028	0.000028	0.1179	0.737260	
A:B:C:D	1	0.000028	0.000028	0.1179	0.737260	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	2.00875	0.040497	49.6029	3.109e-15	***
Block1	0.02750	0.010921	2.5181	0.027005	*
Block2	0.00000	0.000000			
A-1	0.03500	0.017268	2.0269	0.065486	.
A1	0.00000	0.000000			
B-1	0.01250	0.017268	0.7239	0.483007	
B1	0.00000	0.000000			
A1:B1	-0.00625	0.024420	-0.2559	0.802336	
A1:B-1	0.00000	0.000000			
A-1:B1	0.00000	0.000000			
A-1:B-1	0.00000	0.000000			
Block1:A1:B1	-0.05250	0.015445	-3.3992	0.005277	**
Block1:A1:B-1	-0.03000	0.015445	-1.9424	0.075926	.
Block1:A-1:B1	0.01500	0.015445	0.9712	0.350618	
Block1:A-1:B-1	0.00000	0.000000			
Block2:A1:B1	0.00000	0.000000			
Block2:A1:B-1	0.00000	0.000000			
Block2:A-1:B1	0.00000	0.000000			
Block2:A-1:B-1	0.00000	0.000000			
C-1	0.01500	0.015445	0.9712	0.350618	
C1	0.00000	0.000000			
D-1	-0.01000	0.015445	-0.6475	0.529522	
D1	0.00000	0.000000			
C1:D1	0.01500	0.021842	0.6867	0.505299	
C1:D-1	0.00000	0.000000			
C-1:D1	0.00000	0.000000			

C-1:D-1	0.00000	0.000000		
A1:C1	-0.03500	0.021842	-1.6024	0.135048
A1:C-1	0.00000	0.000000		
A-1:C1	0.00000	0.000000		
A-1:C-1	0.00000	0.000000		
A1:D1	-0.04000	0.021842	-1.8313	0.091980 .
A1:D-1	0.00000	0.000000		
A-1:D1	0.00000	0.000000		
A-1:D-1	0.00000	0.000000		
B1:C1	-0.02000	0.021842	-0.9157	0.377880
B1:C-1	0.00000	0.000000		
B-1:C1	0.00000	0.000000		
B-1:C-1	0.00000	0.000000		
B1:D1	-0.03000	0.021842	-1.3735	0.194718
B1:D-1	0.00000	0.000000		
B-1:D1	0.00000	0.000000		
B-1:D-1	0.00000	0.000000		
A1:B1:C1	0.06000	0.030890	1.9424	0.075926 .
A1:B1:C-1	0.00000	0.000000		
A1:B-1:C1	0.00000	0.000000		
A1:B-1:C-1	0.00000	0.000000		
A-1:B1:C1	0.00000	0.000000		
A-1:B1:C-1	0.00000	0.000000		
A-1:B-1:C1	0.00000	0.000000		
A-1:B-1:C-1	0.00000	0.000000		
A1:B1:D1	0.04500	0.030890	1.4568	0.170835
A1:B1:D-1	0.00000	0.000000		
A1:B-1:D1	0.00000	0.000000		
A1:B-1:D-1	0.00000	0.000000		
A-1:B1:D1	0.00000	0.000000		
A-1:B1:D-1	0.00000	0.000000		
A-1:B-1:D1	0.00000	0.000000		
A-1:B-1:D-1	0.00000	0.000000		
A1:C1:D1	0.00000	0.030890	0.0000	1.000000
A1:C1:D-1	0.00000	0.000000		
A1:C-1:D1	0.00000	0.000000		
A1:C-1:D-1	0.00000	0.000000		
A-1:C1:D1	0.00000	0.000000		
A-1:C1:D-1	0.00000	0.000000		
A-1:C-1:D1	0.00000	0.000000		
A-1:C-1:D-1	0.00000	0.000000		
B1:C1:D1	0.00000	0.030890	0.0000	1.000000
B1:C1:D-1	0.00000	0.000000		
B1:C-1:D1	0.00000	0.000000		
B1:C-1:D-1	0.00000	0.000000		
B-1:C1:D1	0.00000	0.000000		
B-1:C1:D-1	0.00000	0.000000		
B-1:C-1:D1	0.00000	0.000000		

B-1:C-1:D-1	0.00000	0.000000		
A1:B1:C1:D1	-0.01500	0.043684	-0.3434	0.737260
A1:B1:C1:D-1	0.00000	0.000000		
A1:B1:C-1:D1	0.00000	0.000000		
A1:B1:C-1:D-1	0.00000	0.000000		
A1:B-1:C1:D1	0.00000	0.000000		
A1:B-1:C1:D-1	0.00000	0.000000		
A1:B-1:C-1:D1	0.00000	0.000000		
A1:B-1:C-1:D-1	0.00000	0.000000		
A-1:B1:C1:D1	0.00000	0.000000		
A-1:B1:C1:D-1	0.00000	0.000000		
A-1:B1:C-1:D1	0.00000	0.000000		
A-1:B1:C-1:D-1	0.00000	0.000000		
A-1:B-1:C1:D1	0.00000	0.000000		
A-1:B-1:C1:D-1	0.00000	0.000000		
A-1:B-1:C-1:D1	0.00000	0.000000		
A-1:B-1:C-1:D-1	0.00000	0.000000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 10.6.2 p320

(176) MODEL

```
GLM(y ~ A*B*C*D*E, plasma) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	31	6672.9	215.26		
RESIDUALS	0	0.0			
CORRECTED TOTAL	31	6672.9			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	1118.65	1118.65		
B	1	142.81	142.81		
A:B	1	141.96	141.96		
C	1	91.80	91.80		
A:C	1	70.81	70.81		
B:C	1	5.78	5.78		
A:B:C	1	65.55	65.55		
D	1	1824.08	1824.08		
A:D	1	2194.53	2194.53		
B:D	1	87.78	87.78		
A:B:D	1	87.12	87.12		



C:D	1	22.45	22.45
A:C:D	1	42.78	42.78
B:C:D	1	12.25	12.25
A:B:C:D	1	375.38	375.38
E	1	78.75	78.75
A:E	1	278.48	278.48
B:E	1	0.72	0.72
A:B:E	1	0.10	0.10
C:E	1	0.15	0.15
A:C:E	1	0.24	0.24
B:C:E	1	6.48	6.48
A:B:C:E	1	1.53	1.53
D:E	1	8.40	8.40
A:D:E	1	5.28	5.28
B:D:E	1	0.28	0.28
A:B:D:E	1	0.60	0.60
C:D:E	1	0.85	0.85
A:C:D:E	1	0.55	0.55
B:C:D:E	1	6.30	6.30
A:B:C:D:E	1	0.50	0.50

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	1118.65	1118.65		
B	1	142.81	142.81		
A:B	1	141.96	141.96		
C	1	91.80	91.80		
A:C	1	70.81	70.81		
B:C	1	5.78	5.78		
A:B:C	1	65.55	65.55		
D	1	1824.08	1824.08		
A:D	1	2194.53	2194.53		
B:D	1	87.78	87.78		
A:B:D	1	87.12	87.12		
C:D	1	22.45	22.45		
A:C:D	1	42.78	42.78		
B:C:D	1	12.25	12.25		
A:B:C:D	1	375.38	375.38		
E	1	78.75	78.75		
A:E	1	278.48	278.48		
B:E	1	0.72	0.72		
A:B:E	1	0.10	0.10		
C:E	1	0.15	0.15		
A:C:E	1	0.24	0.24		
B:C:E	1	6.48	6.48		
A:B:C:E	1	1.53	1.53		
D:E	1	8.40	8.40		
A:D:E	1	5.28	5.28		

B:D:E	1	0.28	0.28
A:B:D:E	1	0.60	0.60
C:D:E	1	0.85	0.85
A:C:D:E	1	0.55	0.55
B:C:D:E	1	6.30	6.30
A:B:C:D:E	1	0.50	0.50

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	1118.64	1118.64		
B	1	142.80	142.80		
A:B	1	141.96	141.96		
C	1	91.80	91.80		
A:C	1	70.81	70.81		
B:C	1	5.78	5.78		
A:B:C	1	65.55	65.55		
D	1	1824.08	1824.08		
A:D	1	2194.53	2194.53		
B:D	1	87.78	87.78		
A:B:D	1	87.12	87.12		
C:D	1	22.45	22.45		
A:C:D	1	42.78	42.78		
B:C:D	1	12.25	12.25		
A:B:C:D	1	375.38	375.38		
E	1	78.75	78.75		
A:E	1	278.48	278.48		
B:E	1	0.72	0.72		
A:B:E	1	0.10	0.10		
C:E	1	0.15	0.15		
A:C:E	1	0.24	0.24		
B:C:E	1	6.48	6.48		
A:B:C:E	1	1.53	1.53		
D:E	1	8.40	8.40		
A:D:E	1	5.28	5.28		
B:D:E	1	0.28	0.28		
A:B:D:E	1	0.60	0.60		
C:D:E	1	0.85	0.85		
A:C:D:E	1	0.55	0.55		
B:C:D:E	1	6.30	6.30		
A:B:C:D:E	1	0.50	0.50		

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	48.2			
A-	-24.3			
A+	0.0			
B-	-5.0			
B+	0.0			

A-:B-	4.8
A-:B+	0.0
A+:B-	0.0
A+:B+	0.0
C-	-10.4
C+	0.0
A-:C-	19.5
A-:C+	0.0
A+:C-	0.0
A+:C+	0.0
B-:C-	23.4
B-:C+	0.0
B+:C-	0.0
B+:C+	0.0
A-:B-:C-	-38.1
A-:B-:C+	0.0
A-:B+:C-	0.0
A-:B+:C+	0.0
A+:B-:C-	0.0
A+:B-:C+	0.0
A+:B+:C-	0.0
A+:B+:C+	0.0
D-	-3.8
D+	0.0
A-:D-	34.5
A-:D+	0.0
A+:D-	0.0
A+:D+	0.0
B-:D-	5.4
B-:D+	0.0
B+:D-	0.0
B+:D+	0.0
A-:B-:D-	-16.3
A-:B-:D+	0.0
A-:B+:D-	0.0
A-:B+:D+	0.0
A+:B-:D-	0.0
A+:B-:D+	0.0
A+:B+:D-	0.0
A+:B+:D+	0.0
C-:D-	17.3
C-:D+	0.0
C+:D-	0.0
C+:D+	0.0
A-:C-:D-	-18.1
A-:C-:D+	0.0
A-:C+:D-	0.0
A-:C+:D+	0.0

A+:C-:D-	0.0
A+:C-:D+	0.0
A+:C+:D-	0.0
A+:C+:D+	0.0
B-:C-:D-	-36.9
B-:C-:D+	0.0
B-:C+:D-	0.0
B-:C+:D+	0.0
B+:C-:D-	0.0
B+:C-:D+	0.0
B+:C+:D-	0.0
B+:C+:D+	0.0
A-:B-:C-:D-	56.8
A-:B-:C-:D+	0.0
A-:B-:C+:D-	0.0
A-:B-:C+:D+	0.0
A-:B+:C-:D-	0.0
A-:B+:C-:D+	0.0
A-:B+:C+:D-	0.0
A-:B+:C+:D+	0.0
A+:B-:C-:D-	0.0
A+:B-:C-:D+	0.0
A+:B-:C+:D-	0.0
A+:B-:C+:D+	0.0
A+:B+:C-:D-	0.0
A+:B+:C-:D+	0.0
A+:B+:C+:D-	0.0
A+:B+:C+:D+	0.0
E-	1.3
E+	0.0
A-:E-	-13.9
A-:E+	0.0
A+:E-	0.0
A+:E+	0.0
B-:E-	3.0
B-:E+	0.0
B+:E-	0.0
B+:E+	0.0
A-:B-:E-	-0.8
A-:B-:E+	0.0
A-:B+:E-	0.0
A-:B+:E+	0.0
A+:B-:E-	0.0
A+:B-:E+	0.0
A+:B+:E-	0.0
A+:B+:E+	0.0
C-:E-	2.7
C-:E+	0.0

C+:E-	0.0
C+:E+	0.0
A-:C-:E-	2.5
A-:C-:E+	0.0
A-:C+:E-	0.0
A-:C+:E+	0.0
A+:C-:E-	0.0
A+:C-:E+	0.0
A+:C+:E-	0.0
A+:C+:E+	0.0
B-:C-:E-	-6.4
B-:C-:E+	0.0
B-:C+:E-	0.0
B-:C+:E+	0.0
B+:C-:E-	0.0
B+:C-:E+	0.0
B+:C+:E-	0.0
B+:C+:E+	0.0
A-:B-:C-:E-	-1.5
A-:B-:C-:E+	0.0
A-:B-:C+:E-	0.0
A-:B-:C+:E+	0.0
A-:B+:C-:E-	0.0
A-:B+:C-:E+	0.0
A-:B+:C+:E-	0.0
A-:B+:C+:E+	0.0
A+:B-:C-:E-	0.0
A+:B-:C-:E+	0.0
A+:B-:C+:E-	0.0
A+:B-:C+:E+	0.0
A+:B+:C-:E-	0.0
A+:B+:C-:E+	0.0
A+:B+:C+:E-	0.0
A+:B+:C+:E+	0.0
D-:E-	3.0
D-:E+	0.0
D+:E-	0.0
D+:E+	0.0
A-:D-:E-	2.2
A-:D-:E+	0.0
A-:D+:E-	0.0
A-:D+:E+	0.0
A+:D-:E-	0.0
A+:D-:E+	0.0
A+:D+:E-	0.0
A+:D+:E+	0.0
B-:D-:E-	-4.9
B-:D-:E+	0.0

B-:D+:E-	0.0
B-:D+:E+	0.0
B+:D-:E-	0.0
B+:D-:E+	0.0
B+:D+:E-	0.0
B+:D+:E+	0.0
A-:B-:D-:E-	4.2
A-:B-:D-:E+	0.0
A-:B-:D+:E-	0.0
A-:B-:D+:E+	0.0
A-:B+:D-:E-	0.0
A-:B+:D-:E+	0.0
A-:B+:D+:E-	0.0
A-:B+:D+:E+	0.0
A+:B-:D-:E-	0.0
A+:B-:D-:E+	0.0
A+:B-:D+:E-	0.0
A+:B-:D+:E+	0.0
A+:B+:D-:E-	0.0
A+:B+:D-:E+	0.0
A+:B+:D+:E-	0.0
A+:B+:D+:E+	0.0
C-:D-:E-	-4.8
C-:D-:E+	0.0
C-:D+:E-	0.0
C-:D+:E+	0.0
C+:D-:E-	0.0
C+:D-:E+	0.0
C+:D+:E-	0.0
C+:D+:E+	0.0
A-:C-:D-:E-	-0.1
A-:C-:D-:E+	0.0
A-:C-:D+:E-	0.0
A-:C-:D+:E+	0.0
A-:C+:D-:E-	0.0
A-:C+:D-:E+	0.0
A-:C+:D+:E-	0.0
A-:C+:D+:E+	0.0
A+:C-:D-:E-	0.0
A+:C-:D-:E+	0.0
A+:C-:D+:E-	0.0
A+:C-:D+:E+	0.0
A+:C+:D-:E-	0.0
A+:C+:D-:E+	0.0
A+:C+:D+:E-	0.0
A+:C+:D+:E+	0.0
B-:C-:D-:E-	9.1
B-:C-:D-:E+	0.0

B-:C-:D+:E-	0.0
B-:C-:D+:E+	0.0
B-:C+:D-:E-	0.0
B-:C+:D-:E+	0.0
B-:C+:D+:E-	0.0
B-:C+:D+:E+	0.0
B+:C-:D-:E-	0.0
B+:C-:D-:E+	0.0
B+:C-:D+:E-	0.0
B+:C-:D+:E+	0.0
B+:C+:D-:E-	0.0
B+:C+:D-:E+	0.0
B+:C+:D+:E-	0.0
B+:C+:D+:E+	0.0
A-:B-:C-:D-:E-	-4.0
A-:B-:C-:D-:E+	0.0
A-:B-:C-:D+:E-	0.0
A-:B-:C-:D+:E+	0.0
A-:B-:C+:D-:E-	0.0
A-:B-:C+:D-:E+	0.0
A-:B-:C+:D+:E-	0.0
A-:B-:C+:D+:E+	0.0
A-:B+:C-:D-:E-	0.0
A-:B+:C-:D-:E+	0.0
A-:B+:C-:D+:E-	0.0
A-:B+:C-:D+:E+	0.0
A-:B+:C+:D-:E-	0.0
A-:B+:C+:D-:E+	0.0
A-:B+:C+:D+:E-	0.0
A-:B+:C+:D+:E+	0.0
A+:B-:C-:D-:E-	0.0
A+:B-:C-:D-:E+	0.0
A+:B-:C-:D+:E-	0.0
A+:B-:C-:D+:E+	0.0
A+:B-:C+:D-:E-	0.0
A+:B-:C+:D-:E+	0.0
A+:B-:C+:D+:E-	0.0
A+:B-:C+:D+:E+	0.0
A+:B+:C-:D-:E-	0.0
A+:B+:C-:D-:E+	0.0
A+:B+:C-:D+:E-	0.0
A+:B+:C-:D+:E+	0.0
A+:B+:C+:D-:E-	0.0
A+:B+:C+:D-:E+	0.0
A+:B+:C+:D+:E-	0.0
A+:B+:C+:D+:E+	0.0

### 10.6.3 p335

(177) MODEL

```
gear$A = as.numeric(as.character(gear$A))
gear$B = as.numeric(as.character(gear$B))
gear$C = as.numeric(as.character(gear$C))
gear$P = as.numeric(as.character(gear$P))
gear$Q = as.numeric(as.character(gear$Q))
REG(y ~ A*B*C + P + Q + A:P + A:Q + B:P + B:Q + C:P + C:Q, gear) # OK
```

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	15.4062			
A	-4.9062			
B	-0.1562			
A:B	0.5312			
C	3.9688			
A:C	2.9062			
B:C	0.4062			
A:B:C	0.5938			
P	-2.3438			
Q	-3.4062			
A:P	-0.9062			
A:Q	-0.3438			
B:P	1.0938			
B:Q	0.1562			
C:P	-0.2812			
C:Q	0.7812			

## 10.7 Chapter 9

### 10.7.1 p349

(178) MODEL

```
GLM(pl ~ Subject + Period + Treat, antifungal) # OK
```

\$ANOVA

Response : pl

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	18	118.558	6.5866	1.4435	0.2388
RESIDUALS	15	68.444	4.5630		
CORRECTED TOTAL	33	187.002			

\$`Type I`



	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	16	114.642	7.1651	1.5703	0.1942
Period	1	0.922	0.9224	0.2021	0.6594
Treat	1	2.993	2.9932	0.6560	0.4306

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	16	114.642	7.1651	1.5703	0.1942
Period	1	0.734	0.7344	0.1609	0.6939
Treat	1	2.993	2.9932	0.6560	0.4306

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	16	114.642	7.1651	1.5703	0.1942
Period	1	0.734	0.7344	0.1609	0.6939
Treat	1	2.993	2.9932	0.6560	0.4306

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	11.9000	1.60208	7.4278	2.121e-06 ***
Subject1	-0.4500	2.13611	-0.2107	0.83598
Subject2	-1.5500	2.13611	-0.7256	0.47924
Subject3	2.7500	2.13611	1.2874	0.21747
Subject4	0.4500	2.13611	0.2107	0.83598
Subject5	2.8000	2.13611	1.3108	0.20964
Subject6	5.2500	2.13611	2.4577	0.02663 *
Subject7	1.4500	2.13611	0.6788	0.50760
Subject8	0.8500	2.13611	0.3979	0.69630
Subject9	2.3500	2.13611	1.1001	0.28862
Subject10	3.2000	2.13611	1.4981	0.15487
Subject11	1.1500	2.13611	0.5384	0.59823
Subject12	0.5000	2.13611	0.2341	0.81810
Subject13	-2.9500	2.13611	-1.3810	0.18750
Subject14	1.2500	2.13611	0.5852	0.56713
Subject15	1.3500	2.13611	0.6320	0.53691
Subject16	0.4500	2.13611	0.2107	0.83598
Subject17	0.0000	0.00000		
Period1	-0.2944	0.73395	-0.4012	0.69395
Period2	0.0000	0.00000		
TreatA	0.5944	0.73395	0.8099	0.43065
TreatB	0.0000	0.00000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 10.7.2 p355

(179) MODEL

```
GLM(y ~ Group + Subject:Group + Period + Treat + Carry, bioequiv) # OK
```

```
$ANOVA
```

```
Response : y
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	39	417852	10714.1	20.367	< 2.2e-16 ***
RESIDUALS	68	35772	526.1		
CORRECTED TOTAL	107	453624			

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group	1	43335	43335	82.3763	2.46e-13 ***
Group:Subject	34	370970	10911	20.7406	< 2.2e-16 ***
Period	2	287	143	0.2723	0.7624
Treat	1	2209	2209	4.1993	0.0443 *
Carry	1	1051	1051	1.9970	0.1622

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type II`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group	1	32616	32616	61.9998	3.712e-11 ***
Group:Subject	34	370970	10911	20.7406	< 2.2e-16 ***
Period	1	38	38	0.0724	0.7888
Treat	1	2209	2209	4.1993	0.0443 *
Carry	1	1051	1051	1.9970	0.1622

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
```

```
CAUTION: Singularity Exists !
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Group	1	32616	32616	61.9998	3.712e-11 ***
Group:Subject	34	370970	10911	20.7406	< 2.2e-16 ***
Period	1	38	38	0.0724	0.7888
Treat	1	2209	2209	4.1993	0.0443 *
Carry	1	1051	1051	1.9970	0.1622

```
---
```

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
```

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	60.210	14.2178	4.2349	7.030e-05 ***
Group1	275.892	18.7922	14.6812	< 2.2e-16 ***
Group2	0.000	0.0000		

Group1:Subject1	0.000	0.0000			
Group1:Subject2	-227.030	18.7273	-12.1230	< 2.2e-16	***
Group1:Subject3	-177.713	18.7273	-9.4896	4.441e-14	***
Group1:Subject4	0.000	0.0000			
Group1:Subject5	0.000	0.0000			
Group1:Subject6	-40.340	18.7273	-2.1541	0.0347809	*
Group1:Subject7	0.000	0.0000			
Group1:Subject8	-295.857	18.7273	-15.7982	< 2.2e-16	***
Group1:Subject9	0.000	0.0000			
Group1:Subject10	-274.273	18.7273	-14.6457	< 2.2e-16	***
Group1:Subject11	0.000	0.0000			
Group1:Subject12	-289.343	18.7273	-15.4504	< 2.2e-16	***
Group1:Subject13	-244.527	18.7273	-13.0573	< 2.2e-16	***
Group1:Subject14	-214.220	18.7273	-11.4389	< 2.2e-16	***
Group1:Subject15	0.000	0.0000			
Group1:Subject16	0.000	0.0000			
Group1:Subject17	0.000	0.0000			
Group1:Subject18	-256.807	18.7273	-13.7130	< 2.2e-16	***
Group1:Subject19	-167.663	18.7273	-8.9529	4.106e-13	***
Group1:Subject21	-196.253	18.7273	-10.4796	8.882e-16	***
Group1:Subject23	-282.743	18.7273	-15.0980	< 2.2e-16	***
Group1:Subject24	0.000	0.0000			
Group1:Subject25	0.000	0.0000			
Group1:Subject26	-175.620	18.7273	-9.3778	7.061e-14	***
Group1:Subject27	0.000	0.0000			
Group1:Subject28	-224.523	18.7273	-11.9891	< 2.2e-16	***
Group1:Subject30	0.000	0.0000			
Group1:Subject31	-231.780	18.7273	-12.3766	< 2.2e-16	***
Group1:Subject32	0.000	0.0000			
Group1:Subject33	0.000	0.0000			
Group1:Subject34	-208.733	18.7273	-11.1460	< 2.2e-16	***
Group1:Subject35	0.000	0.0000			
Group1:Subject36	-236.827	18.7273	-12.6461	< 2.2e-16	***
Group1:Subject120	0.000	0.0000			
Group1:Subject122	0.000	0.0000			
Group1:Subject129	0.000	0.0000			
Group2:Subject1	-12.267	18.7273	-0.6550	0.5146667	
Group2:Subject2	0.000	0.0000			
Group2:Subject3	0.000	0.0000			
Group2:Subject4	97.027	18.7273	5.1810	2.142e-06	***
Group2:Subject5	67.423	18.7273	3.6003	0.0005992	***
Group2:Subject6	0.000	0.0000			
Group2:Subject7	20.703	18.7273	1.1055	0.2728310	
Group2:Subject8	0.000	0.0000			
Group2:Subject9	13.143	18.7273	0.7018	0.4851810	
Group2:Subject10	0.000	0.0000			
Group2:Subject11	102.857	18.7273	5.4924	6.396e-07	***
Group2:Subject12	0.000	0.0000			

Group2:Subject13	0.000	0.0000		
Group2:Subject14	0.000	0.0000		
Group2:Subject15	-1.000	18.7273	-0.0534	0.9575713
Group2:Subject16	47.123	18.7273	2.5163	0.0142246 *
Group2:Subject17	4.540	18.7273	0.2424	0.8091787
Group2:Subject18	0.000	0.0000		
Group2:Subject19	0.000	0.0000		
Group2:Subject21	0.000	0.0000		
Group2:Subject23	0.000	0.0000		
Group2:Subject24	25.713	18.7273	1.3730	0.1742498
Group2:Subject25	37.693	18.7273	2.0128	0.0481026 *
Group2:Subject26	0.000	0.0000		
Group2:Subject27	29.563	18.7273	1.5786	0.1190628
Group2:Subject28	0.000	0.0000		
Group2:Subject30	2.340	18.7273	0.1250	0.9009306
Group2:Subject31	0.000	0.0000		
Group2:Subject32	58.270	18.7273	3.1115	0.0027208 **
Group2:Subject33	39.150	18.7273	2.0905	0.0403104 *
Group2:Subject34	0.000	0.0000		
Group2:Subject35	14.293	18.7273	0.7632	0.4479620
Group2:Subject36	0.000	0.0000		
Group2:Subject120	11.667	18.7273	0.6230	0.5353829
Group2:Subject122	0.000	0.0000		
Group2:Subject129	0.000	0.0000		
Period1	-1.329	6.0442	-0.2199	0.8265839
Period2	-1.454	5.4061	-0.2690	0.7887545
Period3	0.000	0.0000		
TreatA	-9.594	4.6818	-2.0492	0.0443021 *
TreatB	0.000	0.0000		
CarryA	-7.640	5.4061	-1.4132	0.1621674
CarryB	0.000	0.0000		
Carrynone	0.000	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

(180) MODEL

```
GLM(y ~ Subject + Period + Treat + Carry, bioequiv) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	39	417852	10714.1	20.367	< 2.2e-16 ***
RESIDUALS	68	35772	526.1		
CORRECTED TOTAL	107	453624			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	35	414306	11837.3	22.5016	<2e-16 ***
Period	2	287	143.3	0.2723	0.7624
Treat	1	2209	2209.1	4.1993	0.0443 *
Carry	1	1051	1050.6	1.9970	0.1622

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	35	403586	11531.0	21.9194	<2e-16 ***
Period	1	38	38.1	0.0724	0.7888
Treat	1	2209	2209.1	4.1993	0.0443 *
Carry	1	1051	1050.6	1.9970	0.1622

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	35	403586	11531.0	21.9194	<2e-16 ***
Period	1	38	38.1	0.0724	0.7888
Treat	1	2209	2209.1	4.1993	0.0443 *
Carry	1	1051	1050.6	1.9970	0.1622

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	336.10	13.9585	24.0787	< 2.2e-16 ***
Subject1	-288.16	18.7922	-15.3340	< 2.2e-16 ***
Subject2	-227.03	18.7273	-12.1230	< 2.2e-16 ***
Subject3	-177.71	18.7273	-9.4896	4.441e-14 ***
Subject4	-178.87	18.7922	-9.5181	3.952e-14 ***
Subject5	-208.47	18.7922	-11.0934	< 2.2e-16 ***
Subject6	-40.34	18.7273	-2.1541	0.03478 *
Subject7	-255.19	18.7922	-13.5795	< 2.2e-16 ***
Subject8	-295.86	18.7273	-15.7982	< 2.2e-16 ***
Subject9	-262.75	18.7922	-13.9818	< 2.2e-16 ***
Subject10	-274.27	18.7273	-14.6457	< 2.2e-16 ***
Subject11	-173.04	18.7922	-9.2078	1.426e-13 ***
Subject12	-289.34	18.7273	-15.4504	< 2.2e-16 ***
Subject13	-244.53	18.7273	-13.0573	< 2.2e-16 ***
Subject14	-214.22	18.7273	-11.4389	< 2.2e-16 ***
Subject15	-276.89	18.7922	-14.7344	< 2.2e-16 ***
Subject16	-228.77	18.7922	-12.1736	< 2.2e-16 ***

```

Subject17    -271.35    18.7922 -14.4396 < 2.2e-16 ***
Subject18    -256.81    18.7273 -13.7130 < 2.2e-16 ***
Subject19    -167.66    18.7273  -8.9529 4.106e-13 ***
Subject21    -196.25    18.7273 -10.4796 8.882e-16 ***
Subject23    -282.74    18.7273 -15.0980 < 2.2e-16 ***
Subject24    -250.18    18.7922 -13.3129 < 2.2e-16 ***
Subject25    -238.20    18.7922 -12.6754 < 2.2e-16 ***
Subject26    -175.62    18.7273  -9.3778 7.061e-14 ***
Subject27    -246.33    18.7922 -13.1080 < 2.2e-16 ***
Subject28    -224.52    18.7273 -11.9891 < 2.2e-16 ***
Subject30    -273.55    18.7922 -14.5567 < 2.2e-16 ***
Subject31    -231.78    18.7273 -12.3766 < 2.2e-16 ***
Subject32    -217.62    18.7922 -11.5805 < 2.2e-16 ***
Subject33    -236.74    18.7922 -12.5979 < 2.2e-16 ***
Subject34    -208.73    18.7273 -11.1460 < 2.2e-16 ***
Subject35    -261.60    18.7922 -13.9206 < 2.2e-16 ***
Subject36    -236.83    18.7273 -12.6461 < 2.2e-16 ***
Subject120   -264.23    18.7922 -14.0604 < 2.2e-16 ***
Subject122   -275.89    18.7922 -14.6812 < 2.2e-16 ***
Subject129     0.00     0.0000
Period1      -1.33     6.0442  -0.2199  0.82658
Period2      -1.45     5.4061  -0.2690  0.78875
Period3       0.00     0.0000
TreatA       -9.59     4.6818  -2.0492  0.04430 *
TreatB        0.00     0.0000
CarryA       -7.64     5.4061  -1.4132  0.16217
CarryB        0.00     0.0000
Carrynone     0.00     0.0000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

### 10.7.3 p361

(181) MODEL

```
GLM(Time ~ Subject + Period + Treat + Carry, chipman) # OK
```

\$ANOVA

Response : Time

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	17	28.0757	1.65151	64.421	1.139e-12 ***
RESIDUALS	18	0.4615	0.02564		
CORRECTED TOTAL	35	28.5372			

---

```
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	11	24.2084	2.20076	85.8462	3.157e-13 ***
Period	2	3.2065	1.60325	62.5388	7.894e-09 ***
Treat	2	0.4276	0.21382	8.3406	0.002733 **
Carry	2	0.2332	0.11660	4.5484	0.025188 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	11	24.2547	2.20497	86.0105	3.104e-13 ***
Period	1	0.0018	0.00184	0.0717	0.7919554
Treat	2	0.6392	0.31958	12.4661	0.0004003 ***
Carry	2	0.2332	0.11660	4.5484	0.0251881 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Subject	11	24.2547	2.20497	86.0105	3.104e-13 ***
Period	1	0.0018	0.00184	0.0717	0.7919554
Treat	2	0.6392	0.31958	12.4661	0.0004003 ***
Carry	2	0.2332	0.11660	4.5484	0.0251881 *

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	7.2383	0.142461	50.8091	< 2.2e-16 ***
Subject1	-1.9179	0.134755	-14.2326	3.093e-11 ***
Subject2	-1.4912	0.134755	-11.0664	1.838e-09 ***
Subject3	0.4200	0.130732	3.2127	0.0048259 **
Subject4	-1.1700	0.130732	-8.9496	4.788e-08 ***
Subject5	0.3621	0.134755	2.6870	0.0150624 *
Subject6	-0.3046	0.134755	-2.2603	0.0364348 *
Subject7	-1.6946	0.134755	-12.5753	2.366e-10 ***
Subject8	-1.3746	0.134755	-10.2006	6.573e-09 ***
Subject9	-1.5446	0.134755	-11.4622	1.052e-09 ***
Subject10	0.1288	0.134755	0.9554	0.3520132
Subject11	-1.2033	0.130732	-9.2046	3.148e-08 ***
Subject12	0.0000	0.000000		
Period1	0.4550	0.086471	5.2619	5.286e-05 ***
Period2	-0.0175	0.065366	-0.2677	0.7919554
Period3	0.0000	0.000000		
Treat1	-0.2654	0.073081	-3.6318	0.0019073 **
Treat2	-0.3496	0.073081	-4.7835	0.0001487 ***

```

Treat3      0.0000  0.000000
Carry0      0.0000  0.000000
Carry1     -0.2337  0.098049  -2.3840  0.0283404 *
Carry2     -0.2737  0.098049  -2.7920  0.0120418 *
Carry3      0.0000  0.000000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

#### 10.7.4 p372

(182) MODEL

```

residue$lc1 = log(residue$X1)
residue$lc2 = log(residue$X2)
residue$lc3 = log(residue$X3)
residue$lc4 = log(residue$X4)
residue$lc5 = log(residue$X5)
residue$sp = 7*residue$lc2+ 14*residue$lc3 + 30*residue$lc4 + 60*residue$lc5
residue$sm = residue$lc1 + residue$lc2+ residue$lc3 + residue$lc4 + residue$lc5
residue$num = 5*residue$sp - 111*residue$sm
residue$den = 5*4745 - 111^2
residue$k = residue$num/residue$den
residue$HL = -log(2)/residue$k
residue$logHL = log(residue$HL)
GLM(logHL ~ temp*moisture*soil, residue) # OK

```

\$ANOVA

Response : logHL

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	7	7.5133	1.07332	13.543	0.0007329 ***
RESIDUALS	8	0.6340	0.07925		
CORRECTED TOTAL	15	8.1473			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
temp	1	6.0503	6.0503	76.3427	2.303e-05 ***
moisture	1	0.9521	0.9521	12.0134	0.008492 **
temp:moisture	1	0.0013	0.0013	0.0162	0.901779
soil	1	0.4098	0.4098	5.1712	0.052559 .
temp:soil	1	0.0086	0.0086	0.1081	0.750753
moisture:soil	1	0.0860	0.0860	1.0855	0.327921
temp:moisture:soil	1	0.0051	0.0051	0.0648	0.805427

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1



\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
temp	1	6.0503	6.0503	76.3427	2.303e-05 ***
moisture	1	0.9521	0.9521	12.0134	0.008492 **
temp:moisture	1	0.0013	0.0013	0.0162	0.901779
soil	1	0.4098	0.4098	5.1712	0.052559 .
temp:soil	1	0.0086	0.0086	0.1081	0.750753
moisture:soil	1	0.0860	0.0860	1.0855	0.327921
temp:moisture:soil	1	0.0051	0.0051	0.0648	0.805427

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
temp	1	6.0503	6.0503	76.3427	2.303e-05 ***
moisture	1	0.9521	0.9521	12.0134	0.008492 **
temp:moisture	1	0.0013	0.0013	0.0162	0.901779
soil	1	0.4098	0.4098	5.1712	0.052559 .
temp:soil	1	0.0086	0.0086	0.1081	0.750753
moisture:soil	1	0.0860	0.0860	1.0855	0.327921
temp:moisture:soil	1	0.0051	0.0051	0.0648	0.805427

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	4.2566	0.19906	21.3832	2.407e-08 ***
temp10	1.2582	0.28152	4.4695	0.002085 **
temp30	0.0000	0.00000		
moistureH	-0.3591	0.28152	-1.2757	0.237854
moistureL	0.0000	0.00000		
temp10:moistureH	0.0358	0.39813	0.0900	0.930514
temp10:moistureL	0.0000	0.00000		
temp30:moistureH	0.0000	0.00000		
temp30:moistureL	0.0000	0.00000		
soilC	0.4772	0.28152	1.6950	0.128514
soilP	0.0000	0.00000		
temp10:soilC	-0.0209	0.39813	-0.0524	0.959466
temp10:soilP	0.0000	0.00000		
temp30:soilC	0.0000	0.00000		
temp30:soilP	0.0000	0.00000		
moistureH:soilC	-0.2216	0.39813	-0.5567	0.592977
moistureH:soilP	0.0000	0.00000		
moistureL:soilC	0.0000	0.00000		
moistureL:soilP	0.0000	0.00000		
temp10:moistureH:soilC	-0.1434	0.56303	-0.2546	0.805427
temp10:moistureH:soilP	0.0000	0.00000		

```
temp10:moistureL:soilC 0.0000 0.00000
temp10:moistureL:soilP 0.0000 0.00000
temp30:moistureH:soilC 0.0000 0.00000
temp30:moistureH:soilP 0.0000 0.00000
temp30:moistureL:soilC 0.0000 0.00000
temp30:moistureL:soilP 0.0000 0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

## 10.8 Chapter 11

### 10.8.1 p461

(183) MODEL

```
GLM(y ~ x1 + x2 + x1:x2 + x1:x3 + x2:x3, pest) # OK
```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	5	275.642	55.128	160.38	4.631e-07 ***
RESIDUALS	7	2.406	0.344		
CORRECTED TOTAL	12	278.048			

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
x1	1	83.402	83.402	242.6351	1.086e-06 ***
x2	1	161.734	161.734	470.5191	1.116e-07 ***
x1:x2	1	0.246	0.246	0.7169	0.4251627
x1:x3	1	15.663	15.663	45.5660	0.0002649 ***
x2:x3	1	14.596	14.596	42.4614	0.0003291 ***

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
x1	1	215.951	215.951	628.246	4.105e-08 ***
x2	1	175.256	175.256	509.855	8.458e-08 ***
x1:x2	1	0.025	0.025	0.072	0.7961658
x1:x3	1	14.539	14.539	42.298	0.0003330 ***
x2:x3	1	14.596	14.596	42.461	0.0003291 ***

```
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type III`
      Df Sum Sq Mean Sq F value    Pr(>F)
x1      1 178.372 178.372 518.922 7.958e-08 ***
x2      1 145.518 145.518 423.341 1.608e-07 ***
x1:x2    1   0.025   0.025   0.072 0.7961658
x1:x3    1  14.539  14.539  42.298 0.0003330 ***
x2:x3    1  14.596  14.596  42.461 0.0003291 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$Parameter
      Estimate Std. Error  t value Pr(>|t|)
(Intercept)  65.375     0.52373 124.8256 5.587e-13 ***
x1          -16.482     0.72352 -22.7799 7.958e-08 ***
x2          -14.992     0.72864 -20.5752 1.608e-07 ***
x1:x2        -0.665     2.47759  -0.2684 0.7961658
x1:x3        -16.113     2.47759  -6.5037 0.0003330 ***
x2:x3        -16.919     2.59646  -6.5162 0.0003291 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

## 10.8.2 p469

(184) MODEL

```
GLM(y ~ x1 + x2 + x1:x2 + x1:x3 + x2:x3 + x1:x2:x3, polvdat) # OK
```

```
$ANOVA
Response : y
      Df Sum Sq Mean Sq F value    Pr(>F)
MODEL      6 12.5313  2.08854   37.056 0.0005473 ***
RESIDUALS    5  0.2818  0.05636
CORRECTED TOTAL 11 12.8131
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
$`Type I`
      Df Sum Sq Mean Sq F value    Pr(>F)
x1      1 5.4668  5.4668 96.9942 0.0001839 ***
x2      1 0.3660  0.3660  6.4944 0.0513654 .
x1:x2    1 4.6897  4.6897 83.2068 0.0002652 ***
x1:x3    1 1.2450  1.2450 22.0887 0.0053378 **
x2:x3    1 0.4707  0.4707  8.3509 0.0341949 *
x1:x2:x3 1 0.2931  0.2931  5.2004 0.0714991 .
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
x1	1	0.0184	0.0184	0.3265	0.5924707
x2	1	0.2419	0.2419	4.2911	0.0930613 .
x1:x2	1	3.8824	3.8824	68.8834	0.0004147 ***
x1:x3	1	1.4383	1.4383	25.5196	0.0039276 **
x2:x3	1	0.4707	0.4707	8.3509	0.0341949 *
x1:x2:x3	1	0.2931	0.2931	5.2004	0.0714991 .

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
x1	1	0.25744	0.25744	4.5677	0.08562 .
x2	1	0.12956	0.12956	2.2987	0.18992
x1:x2	1	0.65909	0.65909	11.6939	0.01885 *
x1:x3	1	0.26323	0.26323	4.6704	0.08307 .
x2:x3	1	0.12999	0.12999	2.3063	0.18931
x1:x2:x3	1	0.29310	0.29310	5.2004	0.07150 .

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	1.2367	1.6150	0.7657	0.47840
x1	3.1892	1.4922	2.1372	0.08562 .
x2	2.2814	1.5047	1.5162	0.18992
x1:x2	6.9004	2.0179	3.4196	0.01885 *
x1:x3	8.9528	4.1427	2.1611	0.08307 .
x2:x3	5.3135	3.4988	1.5187	0.18931
x1:x2:x3	25.5460	11.2023	2.2804	0.07150 .

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

### 10.8.3 p482

(185) MODEL

```
REG(y ~ x1 + x2 + x3 + x1:x2 + x1:x3 + x2:x3 + x1:z1 + x2:z1 + x3:z1 +  
      x1:x2:z1 + x1:x3:z1 + x2:x3:z1 + x1:z2 + x2:z2 + x3:z2 +  
      x1:x2:z2 + x1:x3:z2 + x2:x3:z2 + x1:z1:z2 + x2:z1:z2 + x3:z1:z2 +  
      x1:x2:z1:z2 + x1:x3:z1:z2 + x2:x3:z1:z2 - 1, MPV) # OK
```

	Estimate	Std. Error	t value	Pr(> t )
x1	346948	294197	1.1793	0.2631550

```

x2                8223            490 16.7869 3.467e-09 ***
x3                1656            459  3.6104 0.0040950 **
x1:x2            -414463        312262 -1.3273 0.2113017
x1:x3            -334747        311426 -1.0749 0.3054382
x2:x3            -6476          1199 -5.4032 0.0002156 ***
x1:z1            103044        328922  0.3133 0.7599297
x2:z1            -2241           548 -4.0924 0.0017824 **
x3:z1             823           513  1.6056 0.1366709
x1:x2:z1         -64013        349120 -0.1834 0.8578546
x1:x3:z1        -123730        348184 -0.3554 0.7290412
x2:x3:z1          4659          1340  3.4765 0.0051806 **
x1:z2            244320        328922  0.7428 0.4731733
x2:z2             886           548  1.6187 0.1338108
x3:z2             86           513  0.1670 0.8704301
x1:x2:z2        -266052        349120 -0.7621 0.4620497
x1:x3:z2        -253151        348184 -0.7271 0.4823761
x2:x3:z2        -1822          1340 -1.3593 0.2012686
x1:z1:z2         259038        328922  0.7875 0.4476062
x2:z1:z2         -137           548 -0.2500 0.8071853
x3:z1:z2          100           513  0.1955 0.8485983
x1:x2:z1:z2     -269527        349120 -0.7720 0.4563702
x1:x3:z1:z2     -269249        348184 -0.7733 0.4556454
x2:x3:z1:z2      -328          1340 -0.2448 0.8111141
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 10.9 Chapter 12

### 10.9.1 p513

(186) MODEL

```
GLM(ybar ~ A + B + C + D + E + F + G, tile) # OK
```

```
$ANOVA
```

```
Response : ybar
```

```

      Df Sum Sq Mean Sq F value Pr(>F)
MODEL      7 0.68737  0.098196
RESIDUALS    0 0.00000
CORRECTED TOTAL 7 0.68737

```

```
$`Type I`
```

```

      Df Sum Sq Mean Sq F value Pr(>F)
A      1 0.04984  0.04984
B      1 0.01992  0.01992
C      1 0.51534  0.51534

```

D	1	0.01532	0.01532
E	1	0.05965	0.05965
F	1	0.00879	0.00879
G	1	0.01851	0.01851

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	0.04984	0.04984		
B	1	0.01992	0.01992		
C	1	0.51534	0.51534		
D	1	0.01532	0.01532		
E	1	0.05965	0.05965		
F	1	0.00879	0.00879		
G	1	0.01851	0.01851		

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	0.04984	0.04984		
B	1	0.01992	0.01992		
C	1	0.51534	0.51534		
D	1	0.01532	0.01532		
E	1	0.05965	0.05965		
F	1	0.00879	0.00879		
G	1	0.01851	0.01851		

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	0.74246			
A	0.07893			
B	-0.04990			
C	0.25381			
D	-0.04376			
E	0.08635			
F	0.03314			
G	-0.04810			

(187) MODEL

```
GLM(lns2 ~ A + B + C + D + E + F + G, tile) # OK
```

\$ANOVA

Response : lns2

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	7	12.305	1.7578		
RESIDUALS	0	0.000			
CORRECTED TOTAL	7	12.305			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	1.6436	1.6436		
B	1	0.3109	0.3109		
C	1	7.1858	7.1858		
D	1	2.3199	2.3199		
E	1	0.0248	0.0248		
F	1	0.7379	0.7379		
G	1	0.0820	0.0820		

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	1.6436	1.6436		
B	1	0.3109	0.3109		
C	1	7.1858	7.1858		
D	1	2.3199	2.3199		
E	1	0.0248	0.0248		
F	1	0.7379	0.7379		
G	1	0.0820	0.0820		

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	1.6436	1.6436		
B	1	0.3109	0.3109		
C	1	7.1858	7.1858		
D	1	2.3199	2.3199		
E	1	0.0248	0.0248		
F	1	0.7379	0.7379		
G	1	0.0820	0.0820		

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	-2.62342			
A	0.45326			
B	-0.19715			
C	0.94775			
D	0.53851			
E	0.05564			
F	0.30372			
G	-0.10125			

## 10.9.2 p521

(188) MODEL

```

strng = reshape(tile,
  direction = "long",
  varying = list(c("y1", "y2")),
  v.names = "y",
  idvar = c("A", "B", "C", "D", "E", "F", "G"),
  timevar = "H",
  times = c(-1, 1))
GLM(y ~ A/H + B/H + C/H + D/H + E/H + F/H + G/H, strng) # OK

```

\$ANOVA

Response : y

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	14	1.65427	0.11816	0.1433	0.9807
RESIDUALS	1	0.82473	0.82473		
CORRECTED TOTAL	15	2.47901			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	0.09968	0.09968	0.1209	0.7870
A:H	1	0.04015	0.04015	0.0487	0.8618
B	1	0.03984	0.03984	0.0483	0.8623
H:B	1	0.00043	0.00043	0.0005	0.9854
C	1	1.03069	1.03069	1.2497	0.4646
H:C	1	0.15307	0.15307	0.1856	0.7410
D	1	0.03064	0.03064	0.0372	0.8788
H:D	1	0.04690	0.04690	0.0569	0.8510
E	1	0.11929	0.11929	0.1446	0.7686
H:E	1	0.01883	0.01883	0.0228	0.9045
F	1	0.01758	0.01758	0.0213	0.9077
H:F	1	0.01384	0.01384	0.0168	0.9180
G	1	0.03702	0.03702	0.0449	0.8671
H:G	1	0.00632	0.00632	0.0077	0.9444

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	0.09968	0.09968	0.1209	0.7870
A:H	1	0.04015	0.04015	0.0487	0.8618
B	1	0.03984	0.03984	0.0483	0.8623
H:B	1	0.00043	0.00043	0.0005	0.9854
C	1	1.03069	1.03069	1.2497	0.4646
H:C	1	0.15307	0.15307	0.1856	0.7410
D	1	0.03064	0.03064	0.0372	0.8788
H:D	1	0.04690	0.04690	0.0569	0.8510
E	1	0.11929	0.11929	0.1446	0.7686
H:E	1	0.01883	0.01883	0.0228	0.9045
F	1	0.01758	0.01758	0.0213	0.9077
H:F	1	0.01384	0.01384	0.0168	0.9180



```
G      1 0.03702 0.03702 0.0449 0.8671
H:G    1 0.00632 0.00632 0.0077 0.9444
```

```
$`Type III`
```

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	0.09968	0.09968	0.1209	0.7870
A:H	1	0.04015	0.04015	0.0487	0.8618
B	1	0.03984	0.03984	0.0483	0.8623
H:B	1	0.00043	0.00043	0.0005	0.9854
C	1	1.03069	1.03069	1.2497	0.4646
H:C	1	0.15307	0.15307	0.1856	0.7410
D	1	0.03064	0.03064	0.0372	0.8788
H:D	1	0.04690	0.04690	0.0569	0.8510
E	1	0.11929	0.11929	0.1446	0.7686
H:E	1	0.01883	0.01883	0.0228	0.9045
F	1	0.01758	0.01758	0.0213	0.9077
H:F	1	0.01384	0.01384	0.0168	0.9180
G	1	0.03702	0.03702	0.0449	0.8671
H:G	1	0.00632	0.00632	0.0077	0.9444

```
$Parameter
```

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	0.74246	0.22704	3.2702	0.1889
A	0.07893	0.22704	0.3477	0.7870
A:H	0.05009	0.22704	0.2206	0.8618
B	-0.04990	0.22704	-0.2198	0.8623
H:B	0.00520	0.22704	0.0229	0.9854
C	0.25381	0.22704	1.1179	0.4646
H:C	0.09781	0.22704	0.4308	0.7410
D	-0.04376	0.22704	-0.1928	0.8788
H:D	0.05414	0.22704	0.2385	0.8510
E	0.08635	0.22704	0.3803	0.7686
H:E	0.03431	0.22704	0.1511	0.9045
F	0.03314	0.22704	0.1460	0.9077
H:F	0.02941	0.22704	0.1296	0.9180
G	-0.04810	0.22704	-0.2119	0.8671
H:G	0.01987	0.22704	0.0875	0.9444

### 10.9.3 p525

```
(189) MODEL
```

```
prod2 = af(prodstd, 1:7)
GLM(Pof ~ A + B + C + D + E + F + G + A:G + A:E:F + B:E:G + C:E:G + C:E:G:F +
      D:E + D:F, prod2) # OK
```

```
$ANOVA
```

Response : Pof

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	47	769.49	16.3721	5.1667	2.737e-05 ***
RESIDUALS	24	76.05	3.1688		
CORRECTED TOTAL	71	845.54			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	2	50.577	25.288	7.9806	0.0022023 **
B	2	13.384	6.692	2.1118	0.1429491
C	2	68.594	34.297	10.8234	0.0004463 ***
D	2	23.674	11.837	3.7355	0.0386914 *
E	1	275.733	275.733	87.0165	1.878e-09 ***
F	1	161.700	161.700	51.0296	2.204e-07 ***
G	1	1.051	1.051	0.3318	0.5699896
A:G	2	26.567	13.284	4.1921	0.0274494 *
A:E:F	7	28.404	4.058	1.2806	0.3013844
B:E:G	7	22.453	3.208	1.0123	0.4475160
C:E:G	6	35.546	5.924	1.8696	0.1277692
C:E:F:G	10	24.607	2.461	0.7766	0.6500534
D:E	2	21.745	10.873	3.4312	0.0489076 *
D:F	2	15.450	7.725	2.4379	0.1086730

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	2	50.577	25.288	7.9806	0.0022023 **
B	2	13.384	6.692	2.1118	0.1429491
C	2	68.594	34.297	10.8234	0.0004463 ***
D	2	23.674	11.837	3.7355	0.0386914 *
E	1	275.733	275.733	87.0165	1.878e-09 ***
F	1	161.700	161.700	51.0296	2.204e-07 ***
G	1	1.051	1.051	0.3318	0.5699896
A:G	2	26.567	13.284	4.1921	0.0274494 *
A:E:F	6	24.623	4.104	1.2951	0.2970196
B:E:G	6	19.770	3.295	1.0398	0.4246194
C:E:G	6	35.546	5.924	1.8696	0.1277692
C:E:F:G	10	24.607	2.461	0.7766	0.6500534
D:E	2	21.745	10.873	3.4312	0.0489076 *
D:F	2	15.450	7.725	2.4379	0.1086730

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

CAUTION: Singularity Exists !

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
A	2	50.577	25.288	7.9806	0.0022023	**
B	2	13.384	6.692	2.1118	0.1429491	
C	2	68.594	34.297	10.8234	0.0004463	***
D	2	23.674	11.837	3.7355	0.0386914	*
E	1	275.733	275.733	87.0165	1.878e-09	***
F	1	161.700	161.700	51.0296	2.204e-07	***
G	1	1.051	1.051	0.3318	0.5699896	
A:G	2	26.567	13.284	4.1921	0.0274494	*
A:E:F	6	24.623	4.104	1.2951	0.2970196	
B:E:G	6	19.770	3.295	1.0398	0.4246194	
C:E:G	6	35.546	5.924	1.8696	0.1277692	
C:E:F:G	10	24.607	2.461	0.7766	0.6500534	
D:E	2	21.745	10.873	3.4312	0.0489076	*
D:F	2	15.450	7.725	2.4379	0.1086730	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )	
(Intercept)	23.9833	1.45344	16.5010	1.332e-14	***
A1	-4.1208	1.14905	-3.5863	0.001487	**
A2	-0.1792	1.14905	-0.1559	0.877395	
A3	0.0000	0.00000			
B1	-1.9500	1.02774	-1.8974	0.069875	.
B2	-0.3000	1.02774	-0.2919	0.772869	
B3	0.0000	0.00000			
C1	0.3000	1.45344	0.2064	0.838215	
C2	2.6333	1.45344	1.8118	0.082552	.
C3	0.0000	0.00000			
D1	1.6042	0.89005	1.8023	0.084067	.
D2	0.2958	0.89005	0.3324	0.742489	
D3	0.0000	0.00000			
E1	-4.2111	1.96797	-2.1398	0.042742	*
E2	0.0000	0.00000			
F1	-3.1556	1.78010	-1.7727	0.088975	.
F2	0.0000	0.00000			
G1	0.0889	1.78010	0.0499	0.960588	
G2	0.0000	0.00000			
A1:G1	2.9750	1.02774	2.8947	0.007959	**
A1:G2	0.0000	0.00000			
A2:G1	1.4250	1.02774	1.3865	0.178329	
A2:G2	0.0000	0.00000			
A3:G1	0.0000	0.00000			
A3:G2	0.0000	0.00000			
A1:E1:F1	2.2667	2.78313	0.8144	0.423407	
A1:E1:F2	2.6333	1.45344	1.8118	0.082552	.
A1:E2:F1	2.7833	1.45344	1.9150	0.067486	.

A1:E2:F2	0.0000	0.00000		
A2:E1:F1	1.9667	2.78313	0.7066	0.486596
A2:E1:F2	1.3500	1.45344	0.9288	0.362226
A2:E2:F1	-0.1000	1.45344	-0.0688	0.945717
A2:E2:F2	0.0000	0.00000		
A3:E1:F1	1.6333	2.37346	0.6882	0.497948
A3:E1:F2	0.0000	0.00000		
A3:E2:F1	0.0000	0.00000		
A3:E2:F2	0.0000	0.00000		
B1:E1:G1	-1.6278	2.78313	-0.5849	0.564092
B1:E1:G2	2.3667	1.45344	1.6283	0.116516
B1:E2:G1	1.3000	1.45344	0.8944	0.379976
B1:E2:G2	0.0000	0.00000		
B2:E1:G1	-3.5611	2.78313	-1.2795	0.212941
B2:E1:G2	1.3500	1.45344	0.9288	0.362226
B2:E2:G1	1.8333	1.45344	1.2614	0.219298
B2:E2:G2	0.0000	0.00000		
B3:E1:G1	-3.1611	2.37346	-1.3319	0.195419
B3:E1:G2	0.0000	0.00000		
B3:E2:G1	0.0000	0.00000		
B3:E2:G2	0.0000	0.00000		
C1:E1:G1	-1.9333	2.05548	-0.9406	0.356294
C1:E1:G2	-2.9000	2.05548	-1.4109	0.171117
C1:E2:G1	-3.4333	2.05548	-1.6703	0.107846
C1:E2:G2	0.0000	0.00000		
C2:E1:G1	-2.4000	2.05548	-1.1676	0.254434
C2:E1:G2	-5.5667	2.05548	-2.7082	0.012273 *
C2:E2:G1	-4.3333	2.05548	-2.1082	0.045643 *
C2:E2:G2	0.0000	0.00000		
C3:E1:G1	0.0000	0.00000		
C3:E1:G2	0.0000	0.00000		
C3:E2:G1	0.0000	0.00000		
C3:E2:G2	0.0000	0.00000		
C1:E1:F1:G1	1.3000	2.05548	0.6325	0.533069
C1:E1:F1:G2	-1.7333	2.05548	-0.8433	0.407402
C1:E1:F2:G1	0.0000	0.00000		
C1:E1:F2:G2	0.0000	0.00000		
C1:E2:F1:G1	-1.5000	2.05548	-0.7298	0.472602
C1:E2:F1:G2	-0.1000	2.05548	-0.0487	0.961600
C1:E2:F2:G1	0.0000	0.00000		
C1:E2:F2:G2	0.0000	0.00000		
C2:E1:F1:G1	0.5667	2.05548	0.2757	0.785149
C2:E1:F1:G2	2.6333	2.05548	1.2811	0.212390
C2:E1:F2:G1	0.0000	0.00000		
C2:E1:F2:G2	0.0000	0.00000		
C2:E2:F1:G1	0.9667	2.05548	0.4703	0.642395
C2:E2:F1:G2	-1.5667	2.05548	-0.7622	0.453373
C2:E2:F2:G1	0.0000	0.00000		

```

C2:E2:F2:G2    0.0000    0.00000
C3:E1:F1:G1    1.8000    2.05548  0.8757  0.389869
C3:E1:F1:G2    0.0000    0.00000
C3:E1:F2:G1    0.0000    0.00000
C3:E1:F2:G2    0.0000    0.00000
C3:E2:F1:G1   -0.3333    2.05548 -0.1622  0.872531
C3:E2:F1:G2    0.0000    0.00000
C3:E2:F2:G1    0.0000    0.00000
C3:E2:F2:G2    0.0000    0.00000
D1:E1          -0.2583    1.02774 -0.2514  0.803675
D1:E2          0.0000    0.00000
D2:E1          2.1917    1.02774  2.1325  0.043397 *
D2:E2          0.0000    0.00000
D3:E1          0.0000    0.00000
D3:E2          0.0000    0.00000
D1:F1          -0.2417    1.02774 -0.2351  0.816092
D1:F2          0.0000    0.00000
D2:F1          -2.0750    1.02774 -2.0190  0.054793 .
D2:F2          0.0000    0.00000
D3:F1          0.0000    0.00000
D3:F2          0.0000    0.00000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

#### 10.9.4 p532

(190) MODEL

```
GLM(torque ~ A + B + C + D + E + A:B + A:C + A:D + A:E, Smotor) # OK
```

\$ANOVA

Response : torque

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	15	0.0112217	0.00074811	102.2	0.009731 **
RESIDUALS	2	0.0000146	0.00000732		
CORRECTED TOTAL	17	0.0112363			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	0.0039545	0.0039545	540.2187	0.001846 **
B	2	0.0003817	0.0001909	26.0732	0.036937 *
C	2	0.0057241	0.0028620	390.9837	0.002551 **
D	2	0.0000265	0.0000133	1.8104	0.355820
E	1	0.0000984	0.0000984	13.4406	0.067009 .

```

A:B  2 0.0010068 0.0005034 68.7668 0.014333 *
A:C  2 0.0000031 0.0000016  0.2134 0.824110
A:D  2 0.0000009 0.0000004  0.0599 0.943521
A:E  1 0.0000258 0.0000258  3.5198 0.201458

```

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	0.0039545	0.0039545	540.2187	0.001846 **
B	2	0.0003817	0.0001909	26.0732	0.036937 *
C	2	0.0032014	0.0016007	218.6753	0.004552 **
D	2	0.0000268	0.0000134	1.8319	0.353123
E	1	0.0000423	0.0000423	5.7744	0.138172
A:B	2	0.0010068	0.0005034	68.7668	0.014333 *
A:C	2	0.0000031	0.0000016	0.2134	0.824110
A:D	2	0.0000052	0.0000026	0.3536	0.738760
A:E	1	0.0000258	0.0000258	3.5198	0.201458

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	0.0034241	0.0034241	467.7636	0.002131 **
B	2	0.0003817	0.0001909	26.0732	0.036937 *
C	2	0.0032014	0.0016007	218.6753	0.004552 **
D	2	0.0000268	0.0000134	1.8319	0.353123
E	1	0.0000423	0.0000423	5.7744	0.138172
A:B	2	0.0010068	0.0005034	68.7668	0.014333 *
A:C	2	0.0000031	0.0000016	0.2134	0.824110
A:D	2	0.0000052	0.0000026	0.3536	0.738760
A:E	1	0.0000258	0.0000258	3.5198	0.201458

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	0.289577	0.0034044	85.0589	0.0001382 ***
A1	-0.032740	0.0042779	-7.6533	0.0166477 *
A2	0.000000	0.0000000		
B1	-0.009206	0.0022091	-4.1673	0.0530418 .
B2	0.013405	0.0022091	6.0681	0.0260991 *
B3	0.000000	0.0000000		
C1	-0.040333	0.0030249	-13.3336	0.0055778 **
C2	-0.023615	0.0030249	-7.8068	0.0160147 *
C3	0.000000	0.0000000		
D1	0.004119	0.0030249	1.3617	0.3063965
D2	0.004196	0.0027056	1.5509	0.2610866

```

D3          0.000000  0.0000000
E1         -0.001008  0.0027056  -0.3726  0.7452485
E2          0.000000  0.0000000
A1:B1       0.029389  0.0031241   9.4070  0.0111124 *
A1:B2      -0.004253  0.0031241  -1.3612  0.3065165
A1:B3       0.000000  0.0000000
A2:B1       0.000000  0.0000000
A2:B2       0.000000  0.0000000
A2:B3       0.000000  0.0000000
A1:C1      -0.002699  0.0042779  -0.6310  0.5925465
A1:C2      -0.001250  0.0042779  -0.2923  0.7976178
A1:C3       0.000000  0.0000000
A2:C1       0.000000  0.0000000
A2:C2       0.000000  0.0000000
A2:C3       0.000000  0.0000000
A1:D1      -0.003579  0.0042779  -0.8367  0.4908121
A1:D2      -0.001141  0.0038262  -0.2983  0.7935889
A1:D3       0.000000  0.0000000
A2:D1       0.000000  0.0000000
A2:D2       0.000000  0.0000000
A2:D3       0.000000  0.0000000
A1:E1      -0.007178  0.0038262  -1.8761  0.2014578
A1:E2       0.000000  0.0000000
A2:E1       0.000000  0.0000000
A2:E2       0.000000  0.0000000
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 10.9.5 p535

(191) MODEL

```
GLM(shrinkage ~ A + B + C + D + E + F + G + A:B + A:C + A:D + A:E + A:F + A:G +
      B:D, inject) # OK
```

\$ANOVA

Response : shrinkage

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	14	6659.4	475.67	129.08	1.97e-05 ***
RESIDUALS	5	18.4	3.68		
CORRECTED TOTAL	19	6677.8			

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
--	----	--------	---------	---------	--------

A	1	770.1	770.1	208.9722	2.858e-05	***
B	1	5076.6	5076.6	1377.6289	2.674e-07	***
C	1	3.1	3.1	0.8311	0.403773	
D	1	7.6	7.6	2.0522	0.211416	
E	1	0.6	0.6	0.1526	0.712112	
F	1	0.6	0.6	0.1526	0.712112	
G	1	95.1	95.1	25.7972	0.003837	**
A:B	1	564.1	564.1	153.0699	6.112e-05	***
A:C	1	10.6	10.6	2.8664	0.151230	
A:D	1	115.6	115.6	31.3602	0.002508	**
A:E	1	14.1	14.1	3.8161	0.108185	
A:F	1	1.6	1.6	0.4240	0.543677	
A:G	1	0.1	0.1	0.0170	0.901459	
B:D	1	0.1	0.1	0.0170	0.901459	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
A	1	770.1	770.1	208.9722	2.858e-05	***
B	1	5076.6	5076.6	1377.6289	2.674e-07	***
C	1	3.1	3.1	0.8311	0.403773	
D	1	7.6	7.6	2.0522	0.211416	
E	1	0.6	0.6	0.1526	0.712112	
F	1	0.6	0.6	0.1526	0.712112	
G	1	95.1	95.1	25.7972	0.003837	**
A:B	1	564.1	564.1	153.0699	6.112e-05	***
A:C	1	10.6	10.6	2.8664	0.151230	
A:D	1	115.6	115.6	31.3602	0.002508	**
A:E	1	14.1	14.1	3.8161	0.108185	
A:F	1	1.6	1.6	0.4240	0.543677	
A:G	1	0.1	0.1	0.0170	0.901459	
B:D	1	0.1	0.1	0.0170	0.901459	

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
A	1	770.1	770.1	208.9722	2.858e-05	***
B	1	5076.6	5076.6	1377.6289	2.674e-07	***
C	1	3.1	3.1	0.8311	0.403773	
D	1	7.6	7.6	2.0522	0.211416	
E	1	0.6	0.6	0.1526	0.712112	
F	1	0.6	0.6	0.1526	0.712112	
G	1	95.1	95.1	25.7972	0.003837	**
A:B	1	564.1	564.1	153.0699	6.112e-05	***
A:C	1	10.6	10.6	2.8664	0.151230	
A:D	1	115.6	115.6	31.3602	0.002508	**



```

A:E  1    14.1    14.1    3.8161  0.108185
A:F  1     1.6     1.6    0.4240  0.543677
A:G  1     0.1     0.1    0.0170  0.901459
B:D  1     0.1     0.1    0.0170  0.901459
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

```

$Parameter
      Estimate Std. Error t value Pr(>|t|)
(Intercept) 27.1000     0.42924 63.1343 1.887e-08 ***
A             6.9375     0.47991 14.4559 2.858e-05 ***
B            17.8125     0.47991 37.1164 2.674e-07 ***
C            -0.4375     0.47991 -0.9116  0.403773
D             0.6875     0.47991  1.4326  0.211416
E             0.1875     0.47991  0.3907  0.712112
F             0.1875     0.47991  0.3907  0.712112
G            -2.4375     0.47991 -5.0791  0.003837 **
A:B           5.9375     0.47991 12.3721 6.112e-05 ***
A:C          -0.8125     0.47991 -1.6930  0.151230
A:D          -2.6875     0.47991 -5.6000  0.002508 **
A:E          -0.9375     0.47991 -1.9535  0.108185
A:F           0.3125     0.47991  0.6512  0.543677
A:G          -0.0625     0.47991 -0.1302  0.901459
B:D          -0.0625     0.47991 -0.1302  0.901459
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

## 10.9.6 p539

(192) MODEL

```

eptax = cbind(eptaxr[1:16,], y2=eptaxr[17:32,9], y3=eptaxr[33:48,9],
              y5=eptaxr[49:64,9])
eptax$ybar = (eptax$y + eptax$y2 + eptax$y3 + eptax$y5)/4
GLM(ybar ~ A + B + C + D + E + F + G + H + A:B + A:C + A:D + A:E + A:F + A:G +
      A:H, eptax) # OK

```

```

$ANOVA
Response : ybar
      Df Sum Sq Mean Sq F value Pr(>F)
MODEL      15  2.8452  0.18968
RESIDUALS    0  0.0000
CORRECTED TOTAL 15  2.8452

```

```

$`Type I`
      Df Sum Sq Mean Sq F value Pr(>F)

```

A	1	0.02686	0.02686
B	1	0.00042	0.00042
C	1	0.06306	0.06306
D	1	2.49443	2.49443
E	1	0.00304	0.00304
F	1	0.03209	0.03209
G	1	0.02954	0.02954
H	1	0.12879	0.12879
A:B	1	0.00047	0.00047
A:C	1	0.03218	0.03218
A:D	1	0.01185	0.01185
A:E	1	0.00380	0.00380
A:F	1	0.01674	0.01674
A:G	1	0.00186	0.00186
A:H	1	0.00012	0.00012

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	0.02686	0.02686		
B	1	0.00042	0.00042		
C	1	0.06306	0.06306		
D	1	2.49443	2.49443		
E	1	0.00304	0.00304		
F	1	0.03209	0.03209		
G	1	0.02954	0.02954		
H	1	0.12879	0.12879		
A:B	1	0.00047	0.00047		
A:C	1	0.03218	0.03218		
A:D	1	0.01185	0.01185		
A:E	1	0.00380	0.00380		
A:F	1	0.01674	0.01674		
A:G	1	0.00186	0.00186		
A:H	1	0.00012	0.00012		

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
A	1	0.02686	0.02686		
B	1	0.00042	0.00042		
C	1	0.06306	0.06306		
D	1	2.49443	2.49443		
E	1	0.00304	0.00304		
F	1	0.03209	0.03209		
G	1	0.02954	0.02954		
H	1	0.12879	0.12879		
A:B	1	0.00047	0.00047		
A:C	1	0.03218	0.03218		
A:D	1	0.01185	0.01185		
A:E	1	0.00380	0.00380		

```

A:F  1 0.01674 0.01674
A:G  1 0.00186 0.00186
A:H  1 0.00012 0.00012

```

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	14.3612			
A	-0.0410			
B	0.0051			
C	-0.0628			
D	-0.3948			
E	-0.0138			
F	0.0448			
G	-0.0430			
H	0.0897			
A:B	0.0054			
A:C	-0.0448			
A:D	0.0272			
A:E	0.0154			
A:F	0.0323			
A:G	-0.0108			
A:H	0.0028			

## 11 Searle - Linear Models 2e

### Reference

- Searle SR, Gruber MHJ. Linear Models 2e, Kindle Edition. John Wiley & Sons Inc. 2016.

### 11.1 7.2 (p390, 59%)

(193) MODEL

```
weight = c(8,13,9,12,7,11,6,12,12,14,9,7,14,16,10,14,11,13)
treatment = c("ta","ta","ta","ta","ta","ta","tb","tb","tb","tb","tc","tc","tc",
              "tc","tc","tc","tc","tc")
variety = c("va","va","va","vc","vd","vd","va","va","vb","vb","vb","vb","vc",
            "vc","vd","vd","vd","vd")
d1 = data.frame(weight, treatment, variety)
GLM(weight ~ treatment*variety, d1)
```

\$ANOVA

Response : weight

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	7	82	11.714	2.0918	0.14
RESIDUALS	10	56	5.600		
CORRECTED TOTAL	17	138			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
treatment	2	10.500	5.250	0.9375	0.42348
variety	3	36.786	12.262	2.1896	0.15232
treatment:variety	2	34.714	17.357	3.0995	0.08965 .

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
treatment	2	9.486	4.7429	0.8469	0.45731
variety	3	36.786	12.2619	2.1896	0.15232
treatment:variety	2	34.714	17.3571	3.0995	0.08965 .

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
treatment	2	12.471	6.2353	1.1134	0.36595
variety	3	34.872	11.6240	2.0757	0.16719
treatment:variety	2	34.714	17.3571	3.0995	0.08965 .

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	12	1.1832	10.1419	1.397e-06 ***
treatmentta	-3	2.0494	-1.4639	0.17395
treatmenttb	5	2.3664	2.1129	0.06075 .
treatmenttc	0	0.0000		
varietyva	-8	3.1305	-2.5555	0.02859 *
varietyvb	-4	2.0494	-1.9518	0.07951 .
varietyvc	3	2.0494	1.4639	0.17395
varietyvd	0	0.0000		
treatmentta:varietyva	9	3.8035	2.3662	0.03953 *
treatmentta:varietyvb	0	0.0000		
treatmentta:varietyvc	0	3.5496	0.0000	1.00000
treatmentta:varietyvd	0	0.0000		
treatmenttb:varietyva	0	0.0000		
treatmenttb:varietyvb	0	0.0000		
treatmenttb:varietyvc	0	0.0000		
treatmenttb:varietyvd	0	0.0000		
treatmenttc:varietyva	0	0.0000		
treatmenttc:varietyvb	0	0.0000		
treatmenttc:varietyvc	0	0.0000		
treatmenttc:varietyvd	0	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

```
options(contrasts = c("contr.sum", "contr.poly"))
Anova(lm(weight ~ treatment*variety, d1), type=3, singular.ok=TRUE) # NOT OK
```

Note: model has aliased coefficients  
 sums of squares computed by model comparison

Anova Table (Type III tests)

Response: weight

	Sum Sq	Df	F values	Pr(>F)
treatment	0.000	0		
variety	0.000	0		
treatment:variety	34.714	2	3.0995	0.08965 .
Residuals	56.000	10		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## 11.2 7.2 (p393, 60%)

(194) MODEL

```
percent = c(31,33,44,36,38,26,37,59,42,42,34,42,28,39,36,32,38,42,36,22,42,46,
            26,37,43)
refinery = c(rep("g",9),rep("n",8),rep("s",8))
process = as.factor(c(1,1,1,1,1,1,2,2,2,1,1,1,1,2,2,2,2,1,1,1,2,2,2,2,2))
source0 = c("t","t","t","t","o","m","t","t","o","m","i","i","i","t","o","m","m",
            "t","o","i","o","o","m","i","i")
d2 = data.frame(percent, refinery, process, source=source0)
GLM(percent ~ refinery*source, d2)
```

\$ANOVA

Response : percent

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
MODEL	10	442.56	44.256	0.6361	0.7616
RESIDUALS	14	974.00	69.571		
CORRECTED TOTAL	24	1416.56			

\$`Type I`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
refinery	2	20.963	10.481	0.1507	0.8615
source	3	266.124	88.708	1.2751	0.3212
refinery:source	5	155.474	31.095	0.4469	0.8086

\$`Type II`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
refinery	2	25.535	12.767	0.1835	0.8343
source	3	266.124	88.708	1.2751	0.3212
refinery:source	5	155.474	31.095	0.4469	0.8086

\$`Type III`

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
refinery	2	10.766	5.383	0.0774	0.9259
source	3	282.633	94.211	1.3542	0.2972
refinery:source	5	155.474	31.095	0.4469	0.8086

\$Parameter

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	42.000	8.3409	5.0354	0.0001822 ***
refineryg	-2.000	9.0093	-0.2220	0.8275243
refineryn	-3.000	11.7959	-0.2543	0.8029412
refinerys	0.000	0.0000		
sourcei	-8.000	9.6313	-0.8306	0.4201255
sourcem	-16.000	11.7959	-1.3564	0.1964425
sourceo	-0.667	9.6313	-0.0692	0.9457944

sourcet	0.000	0.0000		
refineryg:sourcei	0.000	0.0000		
refineryg:sourcem	2.000	14.8428	0.1347	0.8947314
refineryg:sourceo	0.667	11.7959	0.0565	0.9557287
refineryg:sourcet	0.000	0.0000		
refineryn:sourcei	3.667	13.6207	0.2692	0.7917042
refineryn:sourcem	14.333	15.2284	0.9412	0.3625491
refineryn:sourceo	-2.333	15.2284	-0.1532	0.8804095
refineryn:sourcet	0.000	0.0000		
refinerys:sourcei	0.000	0.0000		
refinerys:sourcem	0.000	0.0000		
refinerys:sourceo	0.000	0.0000		
refinerys:sourcet	0.000	0.0000		

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

```
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)

	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	0.5.0	194	194 (100%)	0 (0%)
car	3.0.10	194	< 174 (90%)	>= 20 (10%)

All of the results in sasLM 0.5.0 were identical, while type III SSs of Model (83) and (84) were different from those of SAS in sasLM 0.1.2 package.

Slight differences in the last digits between type II and type III SS (when they should be same) are resulted from the round-to-even number way of R rounding function.

If you are uncertain about the equivalence of the 'sasLM' to 'SAS,' you can use 'SAS University Edition' for free.

If you find any discrepancies, please mail to the author, Kyun-Seop Bae [k@acr.kr](mailto:k@acr.kr).



## 13 Session Information

R version 4.0.3 (2020-10-10)

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\_0.5.0 rmarkdown\_2.6

loaded via a namespace (and not attached):

[1] gmp_0.6-2	zip_2.1.1	Rcpp_1.0.5
[4] compiler_4.0.3	pillar_1.4.7	cellranger_1.1.0
[7] numbers_0.7-5	partitions_1.9-22	forcats_0.5.0
[10] tools_4.0.3	digest_0.6.27	evaluate_0.14
[13] lifecycle_0.2.0	tibble_3.0.4	lattice_0.20-41
[16] pkgconfig_2.0.3	rlang_0.4.10	igraph_1.2.6
[19] openxlsx_4.2.3	curl_4.3	yaml_2.2.1
[22] polynom_1.4-0	haven_2.3.1	xfun_0.20
[25] rio_0.5.16	stringr_1.4.0	knitr_1.30
[28] vctrs_0.3.6	hms_1.0.0	scatterplot3d_0.3-41
[31] combinat_0.0-8	lmtest_0.9-38	vcd_1.4-8
[34] grid_4.0.3	DoE.base_1.1-5	data.table_1.13.6
[37] readxl_1.3.1	conf.design_2.0.0	foreign_0.8-81
[40] FrF2_2.2-2	magrittr_2.0.1	sfsmisc_1.1-8
[43] ellipsis_0.3.1	htmltools_0.5.1	MASS_7.3-53
[46] abind_1.4-5	colorspace_2.0-0	stringi_1.5.3
[49] crayon_1.3.4	zoo_1.8-8	