**Trabalho de iniciação cientifica em Estatística Experimental**

O presente trabalho teve como objetivo desenvolver habilidades no software R, um soft de estatística e disponibilizar a resolução dos exercícios para os futuros alunos do curso.

Utilizou-se da biblioteca ExpDes para realização das análises estatísticas exceto o capítulo 10 de regressão linear e dos exercícios que continham dados suficientes para análise da Apostila de MAF 261- Estatística Experimental, professor Fernando de Souza Bastos.

**Capítulo 4 - Delineamento Inteiramente Casualizado E Capítulo 5 – Procedimentos para Comparações Múltiplas**

# Entrada dos dados EXERCICIO 4.1

# Entrada dos dados EXERCICIO 4.2

# Entrada dos dados EXERCICIO 4.4

# Entrada dos dados EXERCICIO 4.5

# Entrada dos dados EXERCICIO 4.7

**Capítulo 6 - Delineamento em Blocos Casualizados**

# Entrada dos dados EXERCICIO 6.1

# Entrada dos dados EXERCICIO 6.2

# Entrada dos dados EXERCICIO 6.3

# Entrada dos dados EXERCICIO 6.8

# Entrada dos dados EXERCICIO 6.10

# Entrada dos dados EXERCICIO 6.11

**Capítulo 7 - Delineamento em Quadrado Latino**

# Entrada dos dados EXERCICIO 7.1

# Entrada dos dados EXERCICIO 7.4

# Entrada dos dados EXERCICIO 7.6

**Capítulo 8 - Experimentos Fatoriais**

# Entrada dos dados EXERCICIO 8.1

# Entrada dos dados EXERCICIO 8.2

# Entrada dos dados EXERCICIO 8.3

# Entrada dos dados EXERCICIO 8.10

# Entrada dos dados EXERCICIO 8.14

# Entrada dos dados EXERCICIO 8.17

# Entrada dos dados EXERCICIO 8.19

# Entrada dos dados EXERCICIO 8.23

# Entrada dos dados EXERCICIO 8.25

**Capítulo 9 - Experimentos em Parcelas Subdivididas**

# Entrada dos dados EXERCICIO 9.1

# Entrada dos dados EXERCICIO 9.2

# Entrada dos dados EXERCICIO 9.3

# Entrada dos dados EXERCICIO 9.8

**Capítulo 10 – Regressão**

# Entrada dos dados EXERCICIO 10.1

# Entrada dos dados EXERCICIO 10.2

# Entrada dos dados EXERCICIO 10.3

# Entrada dos dados EXERCICIO 10.4

# Entrada dos dados EXERCICIO 10.5

# Entrada dos dados EXERCICIO 10.10

# Entrada dos dados EXERCICIO 10.12

# Entrada dos dados EXERCICIO 10.14

**Obs.: # apenas o primeiro exercício é explicativo**

**Capítulo 4 – Delineamento Inteiramente Casualizado**

> library(ExpDes) # carregando a biblioteca

**# Entrada dos dados EXERCICIO 4.1**

> dados=read.csv2("4.1.csv") # buscando dados em planilha do excel

> dados

trat resp

1 A 25

2 A 26

3 A 20

4 A 23

5 A 21

6 B 31

7 B 25

8 B 28

9 B 27

10 B 24

11 C 22

12 C 26

13 C 28

14 C 25

15 C 29

16 D 33

17 D 29

18 D 31

19 D 34

20 D 28

>

> attach(dados) # tornando as colunas independentes

> crd(trat,resp, quali = TRUE, mcomp='tukey', sigT = 0.05, sigF = 0.05) # comando p/ ANOVA de DIC, com teste de comparações múltiplas tukey.

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

Treatament 3 163.75 54.583 7.7976 0.0019756

Residuals 16 112.00 7.000

Total 19 275.75

------------------------------------------------------------------------

CV = 9.89 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.2358736

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a D 31

ab B 27

b C 26

b A 23

------------------------------------------------------------------------

> crd(trat,resp, quali = TRUE, mcomp='duncan', sigT = 0.05, sigF = 0.05) ) # comando p/ ANOVA de DIC, com teste de comparações múltiplas duncan.

Obs: o comando acima me gerou uma ANOVA que retirei, pois é igual a gerada acima diferindo somente pelo teste de comparações múltiplas.

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a D 31

b B 27

bc C 26

c A 23

------------------------------------------------------------------------

**# Entrada dos dados EXERCICIO 4.2 ###**

> dados=read.csv2("4.2.csv")

> dados

trat resp

1 1 130

2 1 129

3 1 128

4 1 126

5 1 130

6 2 125

7 2 131

8 2 130

9 2 129

10 2 127

11 3 135

12 3 129

13 3 131

14 3 128

15 3 130

> attach(dados)

> crd(trat,resp, quali = TRUE, mcomp='tukey', sigT = 0.01, sigF = 0.01)

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

Treatament 2 14.8 7.4 1.3962 0.285

Residuals 12 63.6 5.3

Total 14 78.4

------------------------------------------------------------------------

CV = 1.78 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.9262885

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

According to the F test, the means can not be considered distinct.

Levels Means

1 1 128.6

2 2 128.4

3 3 130.6

> crd(trat,resp, quali = TRUE, mcomp='duncan', sigT = 0.01, sigF = 0.01)

------------------------------------------------------------------------

According to the F test, the means can not be considered distinct.

Levels Means

1 1 128.6

2 2 128.4

3 3 130.6

----------------------------------------------------------------------

**# Entrada dos dados EXERCICIO 4.4**

> dados=read.csv2("4.4.csv")

> dados

trat resp X.1

1 A 96.0 A- PAOTIDECTOMIZADO

2 A 95.0 B- PSEUDOPAROTIDECTOMIZADO

3 A 100.0 C- NORMAL

4 A 108.0

5 A 120.0

6 A 110.5

7 A 97.0

8 A 92.5

9 B 90.0

10 B 93.0

11 B 89.0

12 B 88.0

13 B 87.0

14 B 92.5

15 B 87.5

16 B 85.0

17 C 86.0

18 C 85.0

19 C 105.0

20 C 105.0

21 C 90.0

22 C 100.0

23 C 95.0

24 C 95.0

>

> attach(dados)

> crd(trat,resp, quali = TRUE, mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

Treatament 2 717.25 358.62 6.7317 0.0055085

Residuals 21 1118.75 53.27

Total 23 1836.00

------------------------------------------------------------------------

CV = 7.64 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.456594

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a A 102.375

ab C 95.125

b B 89

------------------------------------------------------------------------

> crd(trat,resp, quali = TRUE, mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a A 102.375

ab C 95.125

b B 89

------------------------------------------------------------------------

>

**># Entrada dos dados EXERCICIO 4.5**

> dados=read.csv2("4.5.csv")

> dados

trat resp

1 A 29

2 A 27

3 A 31

4 A 29

5 A 32

6 A 30

7 B 27

8 B 27

9 B 30

10 B 28

11 C 30

12 C 30

13 C 31

14 C 27

15 C 29

> attach(dados)

> crd(trat,resp, quali = TRUE, mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

Treatament 2 7.200 3.6000 1.4148 0.28073

Residuals 12 30.533 2.5444

Total 14 37.733

------------------------------------------------------------------------

CV = 5.48 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.7996015

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

According to the F test, the means can not be considered distinct.

Levels Means

1 A 29.66667

2 B 28.00000

3 C 29.40000

------------------------------------------------------------------------

> crd(trat,resp, quali = TRUE, mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

According to the F test, the means can not be considered distinct.

Levels Means

1 A 29.66667

2 B 28.00000

3 C 29.40000

------------------------------------------------------------------------

**# Entrada dos dados EXERCICIO 4.7**

> dados=read.csv2("4.7.csv")

> dados

trat resp

1 A 7.1

2 A 8.9

3 A 6.0

4 A 7.0

5 B 6.2

6 B 8.8

7 B 4.9

8 B 6.1

9 C 6.0

10 C 5.0

11 C 9.1

12 C 3.9

13 D 11.1

14 D 10.8

15 D 10.2

16 D 11.9

17 E 7.0

18 E 11.3

19 E 10.0

20 E 11.7

> attach(dados)

> crd(trat,resp, quali = TRUE, mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

Treatament 4 78.80 19.700 6.9415 0.0022701

Residuals 15 42.57 2.838

Total 19 121.37

------------------------------------------------------------------------

CV = 20.67 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.8909963

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a D 11

ab E 10

bc A 7.25

bc B 6.5

c C 6

------------------------------------------------------------------------

> crd(trat,resp, quali = TRUE, mcomp='duncan', sigT = 0.05, sigF = 0.05)

-----------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a D 11

a E 10

b A 7.25

b B 6.5

b C 6

------------------------------------------------------------------------

**Capítulo 6 – Delineamento Blocos Casualizados**

> library(ExpDes)

**# Entrada dos dados EXERCICIO 6.1**

> dados=read.csv2("6.1.csv")

> dados

bloco trat prod

1 1 1 83

2 1 2 86

3 1 3 103

4 1 4 116

5 1 5 132

6 2 1 63

7 2 2 69

8 2 3 79

9 2 4 81

10 2 5 98

11 3 1 55

12 3 2 61

13 3 3 79

14 3 4 79

15 3 5 91

> attach(dados)

> rbd(trat,bloco,prod, quali = TRUE, mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

Treatament 4 3090 772.5 33.587 4.7637e-05

Block 2 2770 1385.0 60.217 1.5053e-05

Residuals 8 184 23.0

Total 14 6044

------------------------------------------------------------------------

CV = 5.64 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.2591356

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 5 107

b 4 92

b 3 87

c 2 72

c 1 67

------------------------------------------------------------------------

> rbd(trat,bloco,prod, quali = TRUE, mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 5 107

b 4 92

b 3 87

c 2 72

c 1 67

------------------------------------------------------------------------

**# Entrada dos dados EXERCICIO 6.2**

> dados=read.csv2("6.2.csv")

> dados

bloco trat prod

1 1 1 30

2 2 1 32

3 3 1 33

4 4 1 34

5 5 1 29

6 6 1 30

7 7 1 33

8 1 2 29

9 2 2 31

10 3 2 34

11 4 2 31

12 5 2 33

13 6 2 33

14 7 2 29

15 1 3 43

16 2 3 47

17 3 3 46

18 4 3 47

19 5 3 48

20 6 3 44

21 7 3 47

22 1 4 23

23 2 4 25

24 3 4 21

25 4 4 19

26 5 4 20

27 6 4 21

28 7 4 22

> attach(dados)

> rbd(trat,bloco,prod, quali = TRUE, mcomp='tukey', sigT = 0.01, sigF = 0.01)

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

Treatament 3 2125.29 708.43 177.813 0.0000

Block 6 17.43 2.90 0.729 0.6323

Residuals 18 71.71 3.98

Total 27 2214.43

------------------------------------------------------------------------

CV = 6.11 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.2219184

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 3 46

b 1 31.57143

b 2 31.42857

c 4 21.57143

------------------------------------------------------------------------

> rbd(trat,bloco,prod, quali = TRUE, mcomp='duncan', sigT = 0.01, sigF = 0.01)

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 3 46

b 1 31.57143

b 2 31.42857

c 4 21.57143

------------------------------------------------------------------------

**# Entrada dos dados EXERCICIO 6.3**

> dados=read.csv2("6.3.csv")

> dados

bloco trat prod

1 1 1 142.36

2 1 2 139.28

3 1 3 140.73

4 1 4 150.88

5 1 5 153.49

6 2 1 144.78

7 2 2 137.77

8 2 3 134.06

9 2 4 135.83

10 2 5 165.02

11 3 1 145.19

12 3 2 144.44

13 3 3 136.07

14 3 4 136.97

15 3 5 151.75

16 4 1 138.88

17 4 2 130.61

18 4 3 144.11

19 4 4 136.36

20 4 5 150.22

> attach(dados)

> rbd(trat,bloco,prod, quali = TRUE, mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

Treatament 4 794.93 198.732 5.8692 0.00744

Block 3 72.70 24.233 0.7157 0.56136

Residuals 12 406.32 33.860

Total 19 1273.95

------------------------------------------------------------------------

CV = 4.07 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.00557725

WARNING: at 5% of significance, residuals can not be considered normal!

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 5 155.12

ab 1 142.8025

b 4 140.01

b 3 138.7425

b 2 138.025

------------------------------------------------------------------------

> rbd(trat,bloco,prod, quali = TRUE, mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 5 155.12

b 1 142.8025

b 4 140.01

b 3 138.7425

b 2 138.025

------------------------------------------------------------------------

**# Entrada dos dados EXERCICIO 6.8**

> dados=read.csv2("6.8.csv")

> dados

bloco trat prod

1 1 A 9

2 1 B 21

3 1 C 22

4 1 D 15

5 1 E 12

6 2 A 13

7 2 B 27

8 2 C 29

9 2 D 11

10 2 E 18

11 3 A 11

12 3 B 26

13 3 C 24

14 3 D 10

15 3 E 18

16 4 A 9

17 4 B 25

18 4 C 25

19 4 D 12

20 4 E 17

>

> attach(dados)

> rbd(trat,bloco,prod, quali = TRUE, mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

Treatament 4 757.7 189.425 37.697 0.000001

Block 3 36.2 12.067 2.401 0.118590

Residuals 12 60.3 5.025

Total 19 854.2

------------------------------------------------------------------------

CV = 12.66 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.2172983

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a C 25

a B 24.75

b E 16.25

bc D 12

c A 10.5

------------------------------------------------------------------------

> rbd(trat,bloco,prod, quali = TRUE, mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a C 25

a B 24.75

b E 16.25

c D 12

c A 10.5

------------------------------------------------------------------------

**# Entrada dos dados EXERCICIO 6.10**

> dados=read.csv2("6.10.csv")

> dados

bloco trat prod

1 1 1 2.7

2 1 2 2.7

3 1 3 2.6

4 1 4 2.6

5 1 5 2.7

6 2 1 2.8

7 2 2 2.5

8 2 3 3.2

9 2 4 3.1

10 2 5 2.8

11 3 1 2.9

12 3 2 2.8

13 3 3 3.0

14 3 4 2.8

15 3 5 2.8

16 4 1 3.3

17 4 2 2.4

18 4 3 3.5

19 4 4 2.5

20 4 5 2.5

>

> attach(dados)

> rbd(trat,bloco,prod, quali = TRUE, mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

Treatament 4 0.573 0.143250 2.01998 0.15553

Block 3 0.154 0.051333 0.72385 0.55694

Residuals 12 0.851 0.070917

Total 19 1.578

------------------------------------------------------------------------

CV = 9.48 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.5860536

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

According to the F test, the means can not be considered distinct.

Levels Means

1 1 2.925

2 2 2.600

3 3 3.075

4 4 2.750

5 5 2.700

------------------------------------------------------------------------

> rbd(trat,bloco,prod, quali = TRUE, mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

According to the F test, the means can not be considered distinct.

Levels Means

1 1 2.925

2 2 2.600

3 3 3.075

4 4 2.750

5 5 2.700

-----------------------------------------------------------------------

**# Entrada dos dados EXERCICIO 6.11**

> dados=read.csv2("6.11.csv")

> dados

bloco trat prod

1 inf A 3

2 inf B 7

3 adol A 7

4 adol B 13

5 adul A 14

6 adul B 22

7 idos A 8

8 idos B 14

>

> attach(dados)

> rbd(trat,bloco,prod, quali = TRUE, mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

Treatament 1 72 72.000 54 0.0052079

Block 3 172 57.333 43 0.0057768

Residuals 3 4 1.333

Total 7 248

------------------------------------------------------------------------

CV = 10.5 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.09287782

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a B 14

b A 8

------------------------------------------------------------------------

> rbd(trat,bloco,prod, quali = TRUE, mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a B 14

b A 8

------------------------------------------------------------------------

**Capítulo 7 – Delineamento em Quadrado Latino**

# Entrada dos dados EXERCICIO 7.1

> dados=read.csv2("7.1.csv")

> dados

linha coluna trat resp

1 1 1 D 432

2 1 2 A 518

3 1 3 B 458

4 1 4 C 583

5 1 5 E 331

6 2 1 C 724

7 2 2 E 478

8 2 3 A 524

9 2 4 B 555

10 2 5 D 400

11 3 1 E 489

12 3 2 B 384

13 3 3 C 556

14 3 4 D 297

15 3 5 A 420

16 4 1 B 494

17 4 2 D 500

18 4 3 E 313

19 4 4 A 486

20 4 5 C 501

21 5 1 A 515

22 5 2 C 660

23 5 3 D 438

24 5 4 E 394

25 5 5 B 318

> attach(dados)

> latsd(trat,linha,coluna,resp, quali = TRUE, mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

Treatament 4 137195 34299 11.8759 0.000389

Row 4 31131 7783 2.6948 0.082053

Column 4 55559 13890 4.8094 0.015090

Residuals 12 34657 2888

Total 24 258543

------------------------------------------------------------------------

CV = 11.42 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.8115128

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a C 604.8

b A 492.6

b B 441.8

b D 413.4

b E 401

------------------------------------------------------------------------

> latsd(trat,linha,coluna,resp, quali = TRUE, mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a C 604.8

b A 492.6

bc B 441.8

c D 413.4

c E 401

------------------------------------------------------------------------

**# Entrada dos dados EXERCICIO 7.4**

> dados=read.csv2("7.4.csv")

> dados

linhas colunas trat peso

1 1 1 A 93.0

2 1 2 C 110.6

3 1 3 B 102.1

4 1 4 D 115.4

5 1 5 E 117.6

6 2 1 C 115.4

7 2 2 E 96.5

8 2 3 D 108.6

9 2 4 A 94.9

10 2 5 B 114.1

11 3 1 E 116.9

12 3 2 B 108.9

13 3 3 A 77.9

14 3 4 C 114.0

15 3 5 D 118.7

16 4 1 D 110.2

17 4 2 A 97.6

18 4 3 E 102.0

19 4 4 B 100.2

20 4 5 C 108.8

21 5 1 B 110.4

22 5 2 D 112.0

23 5 3 C 111.7

24 5 4 E 118.5

25 5 5 A 80.2

>

> attach(dados)

> latsd(trat,linhas,colunas,peso, quali = TRUE, mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

Treatament 4 2020.05 505.01 9.0167 0.00133

Row 4 48.50 12.12 0.2165 0.92418

Column 4 257.83 64.46 1.1508 0.37964

Residuals 12 672.10 56.01

Total 24 2998.48

------------------------------------------------------------------------

CV = 7.04 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.4380496

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a D 112.98

a C 112.1

a E 110.3

a B 107.14

b A 88.72

------------------------------------------------------------------------

> latsd(trat,linhas,colunas,peso, quali = TRUE, mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a D 112.98

a C 112.1

a E 110.3

a B 107.14

b A 88.72

------------------------------------------------------------------------

**# Entrada dos dados EXERCICIO 7.6**

> dados=read.csv2("7.6.csv")

> dados

linha coluna trat prod

1 1 1 A 450

2 1 2 E 620

3 1 3 C 680

4 1 4 D 420

5 1 5 B 780

6 2 1 C 750

7 2 2 B 990

8 2 3 E 750

9 2 4 A 660

10 2 5 D 830

11 3 1 D 750

12 3 2 C 910

13 3 3 A 690

14 3 4 B 990

15 3 5 E 760

16 4 1 E 650

17 4 2 D 890

18 4 3 B 835

19 4 4 C 850

20 4 5 A 875

21 5 1 B 750

22 5 2 A 720

23 5 3 D 850

24 5 4 E 770

25 5 5 C 890

> attach(dados)

> latsd(trat,linha,coluna,prod, quali = TRUE, mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

Treatament 4 120626 30156 5.2830 0.010896

Row 4 192976 48244 8.4518 0.001754

Column 4 86666 21666 3.7957 0.032206

Residuals 12 68498 5708

Total 24 468766

------------------------------------------------------------------------

CV = 9.88 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.9081459

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a B 869

ab C 816

ab D 748

b E 710

b A 679

------------------------------------------------------------------------

> latsd(trat,linha,coluna,prod, quali = TRUE, mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a B 869

ab C 816

bc D 748

bc E 710

c A 679

------------------------------------------------------------------------

**Capítulo 8 - Experimentos Fatoriais**

**# Entrada dos dados EXERCICIO 8.1**

> dados=read.csv2("8.1.csv")

> dados

fator.a fator.b resp

1 A0 B0 25

2 A0 B0 32

3 A0 B0 27

4 A0 B1 35

5 A0 B1 28

6 A0 B1 33

7 A1 B0 41

8 A1 B0 35

9 A1 B0 38

10 A1 B1 60

11 A1 B1 67

12 A1 B1 59

>

> attach(dados)

> fat2.crd(fator.a,fator.b,resp, quali = c(TRUE,TRUE), mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1: F1

FACTOR 2: F2

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

F1 1 1200 1200.0 88.889 0.00001315

F2 1 588 588.0 43.556 0.00016945

F1\*F2 1 300 300.0 22.222 0.00151375

Residuals 8 108 13.5

Total 11 2196

------------------------------------------------------------------------

CV = 9.19 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.2244004

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Significant interaction: analyzing the interaction

------------------------------------------------------------------------

Analyzing F1 inside of each level of F2

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F2 1 588 588.0000 43.5556 2e-04

F2:F1 B0 1 150 150.0000 11.1111 0.0103

F2:F1 B1 1 1350 1350.0000 100 0

Residuals 8 108 13.5000

Total 11 2196 199.6364

------------------------------------------------------------------------

F1 inside of the level B0 of F2

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 2 38

b 1 28

------------------------------------------------------------------------

F1 inside of the level B1 of F2

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 2 62

b 1 32

------------------------------------------------------------------------

Analyzing F2 inside of each level of F1

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F1 1 1200 1200.0000 88.8889 0

F1:F2 A0 1 24 24.0000 1.7778 0.2191

F1:F2 A1 1 864 864.0000 64 0

Residuals 8 108 13.5000

Total 11 2196 199.6364

------------------------------------------------------------------------

F2 inside of the level A0 of F1

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 28

2 2 32

------------------------------------------------------------------------

F2 inside of the level A1 of F1

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 2 62

b 1 38

------------------------------------------------------------------------

> fat2.crd(fator.a,fator.b,resp, quali = c(TRUE,TRUE), mcomp='duncan', sigT = 0.05, sigF = 0.05)

F1 inside of the level B0 of F2

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 2 38

b 1 28

------------------------------------------------------------------------

F1 inside of the level B1 of F2

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 2 62

b 1 32

------------------------------------------------------------------------

Analyzing F2 inside of each level of F1

------------------------------------------------------------------------

F2 inside of the level A0 of F1

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 28

2 2 32

------------------------------------------------------------------------

F2 inside of the level A1 of F1

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 2 62

b 1 38

------------------------------------------------------------------------

**# Entrada dos dados EXERCICIO 8.2**

> dados=read.csv2("8.2.csv")

> dados

fator.a fator.b resp

1 N0 P0 10.5

2 N0 P0 11.0

3 N0 P0 9.8

4 N0 P0 11.2

5 N0 P0 9.9

6 N0 P1 11.2

7 N0 P1 11.0

8 N0 P1 10.4

9 N0 P1 13.1

10 N0 P1 10.6

11 N1 P0 11.5

12 N1 P0 12.4

13 N1 P0 10.2

14 N1 P0 12.7

15 N1 P0 10.4

16 N1 P1 14.0

17 N1 P1 14.1

18 N1 P1 13.8

19 N1 P1 13.5

20 N1 P1 14.2

>

> attach(dados)

> fat2.crd(fator.a,fator.b,resp, quali = c(TRUE,TRUE), mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1: F1

FACTOR 2: F2

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

F1 1 16.380 16.3805 22.4775 0.000221

F2 1 13.284 13.2845 18.2292 0.000587

F1\*F2 1 3.613 3.6125 4.9571 0.040699

Residuals 16 11.660 0.7288

Total 19 44.937

------------------------------------------------------------------------

CV = 7.25 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.7498233

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Significant interaction: analyzing the interaction

------------------------------------------------------------------------

Analyzing F1 inside of each level of F2

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F2 1 13.2845 13.28450 18.2292 6e-04

F2:F1 P0 1 2.3040 2.30400 3.1616 0.0944

F2:F1 P1 1 17.6890 17.68900 24.2731 2e-04

Residuals 16 11.6600 0.72875

Total 19 44.9375 2.36513

------------------------------------------------------------------------

F1 inside of the level P0 of F2

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 10.48

2 2 11.44

------------------------------------------------------------------------

F1 inside of the level P1 of F2

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 2 13.92

b 1 11.26

------------------------------------------------------------------------

Analyzing F2 inside of each level of F1

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F1 1 16.3805 16.38050 22.4775 2e-04

F1:F2 N0 1 1.5210 1.52100 2.0871 0.1678

F1:F2 N1 1 15.3760 15.37600 21.0991 3e-04

Residuals 16 11.6600 0.72875

Total 19 44.9375 2.36513

------------------------------------------------------------------------

F2 inside of the level N0 of F1

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 10.48

2 2 11.26

------------------------------------------------------------------------

F2 inside of the level N1 of F1

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 2 13.92

b 1 11.44

------------------------------------------------------------------------

> fat2.crd(fator.a,fator.b,resp, quali = c(TRUE,TRUE), mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1: F1

FACTOR 2: F2

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

F1 1 16.380 16.3805 22.4775 0.000221

F2 1 13.284 13.2845 18.2292 0.000587

F1\*F2 1 3.613 3.6125 4.9571 0.040699

Residuals 16 11.660 0.7288

Total 19 44.937

------------------------------------------------------------------------

CV = 7.25 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.7498233

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Significant interaction: analyzing the interaction

------------------------------------------------------------------------

Analyzing F1 inside of each level of F2

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F2 1 13.2845 13.28450 18.2292 6e-04

F2:F1 P0 1 2.3040 2.30400 3.1616 0.0944

F2:F1 P1 1 17.6890 17.68900 24.2731 2e-04

Residuals 16 11.6600 0.72875

Total 19 44.9375 2.36513

------------------------------------------------------------------------

F1 inside of the level P0 of F2

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 10.48

2 2 11.44

------------------------------------------------------------------------

F1 inside of the level P1 of F2

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 2 13.92

b 1 11.26

------------------------------------------------------------------------

Analyzing F2 inside of each level of F1

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F1 1 16.3805 16.38050 22.4775 2e-04

F1:F2 N0 1 1.5210 1.52100 2.0871 0.1678

F1:F2 N1 1 15.3760 15.37600 21.0991 3e-04

Residuals 16 11.6600 0.72875

Total 19 44.9375 2.36513

------------------------------------------------------------------------

F2 inside of the level N0 of F1

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 10.48

2 2 11.26

------------------------------------------------------------------------

F2 inside of the level N1 of F1

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 2 13.92

b 1 11.44

------------------------------------------------------------------------

>

**# Entrada dos dados EXERCICIO 8.3**

> dados=read.csv2("8.3.csv")

> dados

F1 F2 resp

1 CC CL 50

2 CC CL 52

3 CC CL 48

4 CC CL 54

5 CC CL 52

6 CC CL 50

7 CC SL 49

8 CC SL 52

9 CC SL 50

10 CC SL 48

11 CC SL 46

12 CC SL 45

13 SC CL 42

14 SC CL 44

15 SC CL 46

16 SC CL 43

17 SC CL 44

18 SC CL 45

19 SC SL 40

20 SC SL 40

21 SC SL 38

22 SC SL 39

23 SC SL 41

24 SC SL 43

>

> attach(dados)

> fat2.crd(F1,F2,resp, quali = c(TRUE,TRUE), mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1: F1

FACTOR 2: F2

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

F1 1 345.04 345.04 86.081 0.00000

F2 1 63.37 63.38 15.811 0.00074

F1\*F2 1 2.04 2.04 0.509 0.48366

Residuals 20 80.17 4.01

Total 23 490.62

------------------------------------------------------------------------

CV = 4.36 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.8826623

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Not significant interaction: analyzing the simple effect

------------------------------------------------------------------------

F1

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a CC 49.66667

b SC 42.08333

------------------------------------------------------------------------

F2

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a CL 47.5

b SL 44.25

------------------------------------------------------------------------

> fat2.crd(F1,F2,resp, quali = c(TRUE,TRUE), mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1: F1

FACTOR 2: F2

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

F1 1 345.04 345.04 86.081 0.00000

F2 1 63.37 63.38 15.811 0.00074

F1\*F2 1 2.04 2.04 0.509 0.48366

Residuals 20 80.17 4.01

Total 23 490.62

------------------------------------------------------------------------

CV = 4.36 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.8826623

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Not significant interaction: analyzing the simple effect

------------------------------------------------------------------------

F1

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a CC 49.66667

b SC 42.08333

------------------------------------------------------------------------

F2

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a CL 47.5

b SL 44.25

------------------------------------------------------------------------

**# Entrada dos dados EXERCICIO 8.10**

> dados=read.csv2("8.10.csv")

> dados

F1 F2 resp

1 A1 B1 12

2 A1 B1 14

3 A1 B1 16

4 A1 B2 18

5 A1 B2 17

6 A1 B2 20

7 A1 B3 22

8 A1 B3 21

9 A1 B3 20

10 A2 B1 15

11 A2 B1 17

12 A2 B1 18

13 A2 B2 22

14 A2 B2 23

15 A2 B2 23

16 A2 B3 30

17 A2 B3 31

18 A2 B3 32

19 A3 B1 20

20 A3 B1 21

21 A3 B1 23

22 A3 B2 25

23 A3 B2 26

24 A3 B2 28

25 A3 B3 29

26 A3 B3 32

27 A3 B3 32

28 A4 B1 23

29 A4 B1 24

30 A4 B1 26

31 A4 B2 29

32 A4 B2 30

33 A4 B2 32

34 A4 B3 34

35 A4 B3 35

36 A4 B3 37

>

> attach(dados)

> fat2.crd(F1,F2,resp, quali = c(TRUE,TRUE), mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1: F1

FACTOR 2: F2

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

F1 3 714.97 238.32 111.424 0.000000

F2 2 661.56 330.78 154.649 0.000000

F1\*F2 6 46.44 7.74 3.619 0.010654

Residuals 24 51.33 2.14

Total 35 1474.31

------------------------------------------------------------------------

CV = 6 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.02773403

WARNING: at 5% of significance, residuals can not be considered normal!

------------------------------------------------------------------------

Significant interaction: analyzing the interaction

------------------------------------------------------------------------

Analyzing F1 inside of each level of F2

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F2 2 661.55556 330.77778 154.6494 0

F2:F1 B1 3 192.91667 64.30556 30.0649 0

F2:F1 B2 3 236.25000 78.75000 36.8182 0

F2:F1 B3 3 332.25000 110.75000 51.7792 0

Residuals 24 51.33333 2.13889

Total 35 1474.30556 42.12302

------------------------------------------------------------------------

F1 inside of the level B1 of F2

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 4 24.33333

a 3 21.33333

b 2 16.66667

b 1 14

------------------------------------------------------------------------

F1 inside of the level B2 of F2

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 4 30.33333

b 3 26.33333

c 2 22.66667

d 1 18.33333

------------------------------------------------------------------------

F1 inside of the level B3 of F2

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 4 35.33333

b 2 31

b 3 31

c 1 21

------------------------------------------------------------------------

Analyzing F2 inside of each level of F1

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F1 3 714.97222 238.32407 111.4242 0

F1:F2 A1 2 74.88889 37.44444 17.5065 0

F1:F2 A2 2 310.88889 155.44444 72.6753 0

F1:F2 A3 2 140.22222 70.11111 32.7792 0

F1:F2 A4 2 182.00000 91.00000 42.5455 0

Residuals 24 51.33333 2.13889

Total 35 1474.30556 42.12302

------------------------------------------------------------------------

F2 inside of the level A1 of F1

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 3 21

a 2 18.33333

b 1 14

------------------------------------------------------------------------

F2 inside of the level A2 of F1

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 3 31

b 2 22.66667

c 1 16.66667

------------------------------------------------------------------------

F2 inside of the level A3 of F1

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 3 31

b 2 26.33333

c 1 21.33333

------------------------------------------------------------------------

F2 inside of the level A4 of F1

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 3 35.33333

b 2 30.33333

c 1 24.33333

------------------------------------------------------------------------

> fat2.crd(F1,F2,resp, quali = c(TRUE,TRUE), mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1: F1

FACTOR 2: F2

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

F1 3 714.97 238.32 111.424 0.000000

F2 2 661.56 330.78 154.649 0.000000

F1\*F2 6 46.44 7.74 3.619 0.010654

Residuals 24 51.33 2.14

Total 35 1474.31

------------------------------------------------------------------------

CV = 6 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.02773403

WARNING: at 5% of significance, residuals can not be considered normal!

------------------------------------------------------------------------

Significant interaction: analyzing the interaction

------------------------------------------------------------------------

Analyzing F1 inside of each level of F2

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F2 2 661.55556 330.77778 154.6494 0

F2:F1 B1 3 192.91667 64.30556 30.0649 0

F2:F1 B2 3 236.25000 78.75000 36.8182 0

F2:F1 B3 3 332.25000 110.75000 51.7792 0

Residuals 24 51.33333 2.13889

Total 35 1474.30556 42.12302

------------------------------------------------------------------------

F1 inside of the level B1 of F2

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 4 24.33333

b 3 21.33333

c 2 16.66667

d 1 14

------------------------------------------------------------------------

F1 inside of the level B2 of F2

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 4 30.33333

b 3 26.33333

c 2 22.66667

d 1 18.33333

------------------------------------------------------------------------

F1 inside of the level B3 of F2

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 4 35.33333

b 2 31

b 3 31

c 1 21

------------------------------------------------------------------------

Analyzing F2 inside of each level of F1

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F1 3 714.97222 238.32407 111.4242 0

F1:F2 A1 2 74.88889 37.44444 17.5065 0

F1:F2 A2 2 310.88889 155.44444 72.6753 0

F1:F2 A3 2 140.22222 70.11111 32.7792 0

F1:F2 A4 2 182.00000 91.00000 42.5455 0

Residuals 24 51.33333 2.13889

Total 35 1474.30556 42.12302

------------------------------------------------------------------------

F2 inside of the level A1 of F1

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 3 21

b 2 18.33333

c 1 14

------------------------------------------------------------------------

F2 inside of the level A2 of F1

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 3 31

b 2 22.66667

c 1 16.66667

------------------------------------------------------------------------

F2 inside of the level A3 of F1

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 3 31

b 2 26.33333

c 1 21.33333

------------------------------------------------------------------------

F2 inside of the level A4 of F1

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 3 35.33333

b 2 30.33333

c 1 24.33333

------------------------------------------------------------------------

>

**# Entrada dos dados EXERCICIO 8.14**

**> dados=read.csv2("8.14.csv")**

**> dados**

**bloco F1 F2 resp**

**1 1 A1 B1 46.8**

**2 1 A1 B2 48.2**

**3 1 A1 B3 47.3**

**4 1 A1 B4 49.0**

**5 1 A1 B5 48.5**

**6 1 A1 B6 46.9**

**7 2 A2 B1 47.2**

**8 2 A2 B2 60.8**

**9 2 A2 B3 69.3**

**10 2 A2 B4 71.6**

**11 2 A2 B5 61.5**

**12 2 A2 B6 46.8**

**>**

**> attach(dados)**

**> fat2.rbd(bloco,F1,F2,resp, quali = c(TRUE,TRUE,TRUE), mcomp='tukey', sigT = 0.05, sigF = 0.05)**

**------------------------------------------------------------------------**

**Legend:**

**FACTOR 1: F1**

**FACTOR 2: F2**

**------------------------------------------------------------------------**

**Error in `row.names<-.data.frame`(`\*tmp\*`, value = value) :**

**invalid 'row.names' length**

**> fat2.rbd(bloco,F1,F2,resp, quali = c(TRUE,TRUE), mcomp='duncan', sigT = 0.05, sigF = 0.05)**

**------------------------------------------------------------------------**

**Legend:**

**FACTOR 1: F1**

**FACTOR 2: F2**

**------------------------------------------------------------------------**

**Error in `row.names<-.data.frame`(`\*tmp\*`, value = value) :**

**invalid 'row.names' length**

**>?**

**# Entrada dos dados EXERCICIO 8.17**

> dados=read.csv2("8.17.csv")

> dados

F1 F2 resp

1 A1 B1 12

2 A1 B1 14

3 A1 B1 16

4 A1 B2 15

5 A1 B2 17

6 A1 B2 18

7 A1 B3 12

8 A1 B3 11

9 A1 B3 13

10 A2 B1 14

11 A2 B1 13

12 A2 B1 16

13 A2 B2 11

14 A2 B2 12

15 A2 B2 11

16 A2 B3 12

17 A2 B3 12

18 A2 B3 13

>

> fat2.crd(F1,F2,resp, quali = c(TRUE,TRUE), mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1: F1

FACTOR 2: F2

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

F1 1 10.889 10.8889 6.3226 0.027184

F2 2 14.778 7.3889 4.2903 0.039295

F1\*F2 2 32.111 16.0556 9.3226 0.003605

Residuals 12 20.667 1.7222

Total 17 78.444

------------------------------------------------------------------------

CV = 9.76 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.8243212

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Significant interaction: analyzing the interaction

------------------------------------------------------------------------

Analyzing F1 inside of each level of F2

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F2 2 14.77778 7.38889 4.2903 0.0393

F2:F1 B1 1 0.16667 0.16667 0.0968 0.7611

F2:F1 B2 1 42.66667 42.66667 24.7742 3e-04

F2:F1 B3 1 0.16667 0.16667 0.0968 0.7611

Residuals 12 20.66667 1.72222

Total 17 78.44444 4.61438

------------------------------------------------------------------------

F1 inside of the level B1 of F2

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 14.00000

2 2 14.33333

------------------------------------------------------------------------

F1 inside of the level B2 of F2

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 1 16.66667

b 2 11.33333

------------------------------------------------------------------------

F1 inside of the level B3 of F2

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 12.00000

2 2 12.33333

------------------------------------------------------------------------

Analyzing F2 inside of each level of F1

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F1 1 10.88889 10.88889 6.3226 0.0272

F1:F2 A1 2 32.88889 16.44444 9.5484 0.0033

F1:F2 A2 2 14.00000 7.00000 4.0645 0.0449

Residuals 12 20.66667 1.72222

Total 17 78.44444 4.61438

------------------------------------------------------------------------

F2 inside of the level A1 of F1

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 2 16.66667

ab 1 14

b 3 12

------------------------------------------------------------------------

F2 inside of the level A2 of F1

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 1 14.33333

ab 3 12.33333

b 2 11.33333

------------------------------------------------------------------------

> fat2.crd(F1,F2,resp, quali = c(TRUE,TRUE), mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1: F1

FACTOR 2: F2

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

F1 1 10.889 10.8889 6.3226 0.027184

F2 2 14.778 7.3889 4.2903 0.039295

F1\*F2 2 32.111 16.0556 9.3226 0.003605

Residuals 12 20.667 1.7222

Total 17 78.444

------------------------------------------------------------------------

CV = 9.76 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.8243212

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Significant interaction: analyzing the interaction

------------------------------------------------------------------------

Analyzing F1 inside of each level of F2

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F2 2 14.77778 7.38889 4.2903 0.0393

F2:F1 B1 1 0.16667 0.16667 0.0968 0.7611

F2:F1 B2 1 42.66667 42.66667 24.7742 3e-04

F2:F1 B3 1 0.16667 0.16667 0.0968 0.7611

Residuals 12 20.66667 1.72222

Total 17 78.44444 4.61438

------------------------------------------------------------------------

F1 inside of the level B1 of F2

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 14.00000

2 2 14.33333

------------------------------------------------------------------------

F1 inside of the level B2 of F2

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 1 16.66667

b 2 11.33333

------------------------------------------------------------------------

F1 inside of the level B3 of F2

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 12.00000

2 2 12.33333

------------------------------------------------------------------------

Analyzing F2 inside of each level of F1

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F1 1 10.88889 10.88889 6.3226 0.0272

F1:F2 A1 2 32.88889 16.44444 9.5484 0.0033

F1:F2 A2 2 14.00000 7.00000 4.0645 0.0449

Residuals 12 20.66667 1.72222

Total 17 78.44444 4.61438

------------------------------------------------------------------------

F2 inside of the level A1 of F1

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 2 16.66667

b 1 14

b 3 12

------------------------------------------------------------------------

F2 inside of the level A2 of F1

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 1 14.33333

ab 3 12.33333

b 2 11.33333

------------------------------------------------------------------------

>

**# Entrada dos dados EXERCICIO 8.19**

> dados=read.csv2("8.19.csv")

> dados

F1 F2 resp

1 H1 T1 39

2 H1 T1 35

3 H1 T1 49

4 H1 T1 40

5 H1 T1 45

6 H2 T1 43

7 H2 T1 41

8 H2 T1 47

9 H2 T1 38

10 H2 T1 48

11 H3 T1 56

12 H3 T1 52

13 H3 T1 57

14 H3 T1 59

15 H3 T1 58

16 H1 T2 54

17 H1 T2 61

18 H1 T2 59

19 H1 T2 56

20 H1 T2 58

21 H2 T2 67

22 H2 T2 62

23 H2 T2 59

24 H2 T2 64

25 H2 T2 65

26 H3 T2 71

27 H3 T2 73

28 H3 T2 74

29 H3 T2 77

30 H3 T2 75

>

> attach(dados)

> fat2.crd(F1,F2,resp, quali = c(TRUE,TRUE), mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1: F1

FACTOR 2: F2

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

F1 2 1323.5 661.73 52.242 0.00000

F2 1 2394.1 2394.13 189.011 0.00000

F1\*F2 2 20.3 10.13 0.800 0.46095

Residuals 24 304.0 12.67

Total 29 4041.9

------------------------------------------------------------------------

CV = 6.35 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.9874

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Not significant interaction: analyzing the simple effect

------------------------------------------------------------------------

F1

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a H3 65.2

b H2 53.4

b H1 49.6

------------------------------------------------------------------------

F2

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a T2 65

b T1 47.13333

------------------------------------------------------------------------

> fat2.crd(F1,F2,resp, quali = c(TRUE,TRUE), mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1: F1

FACTOR 2: F2

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

F1 2 1323.5 661.73 52.242 0.00000

F2 1 2394.1 2394.13 189.011 0.00000

F1\*F2 2 20.3 10.13 0.800 0.46095

Residuals 24 304.0 12.67

Total 29 4041.9

------------------------------------------------------------------------

CV = 6.35 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.9874

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Not significant interaction: analyzing the simple effect

------------------------------------------------------------------------

F1

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a H3 65.2

b H2 53.4

c H1 49.6

------------------------------------------------------------------------

F2

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a T2 65

b T1 47.13333

------------------------------------------------------------------------

**# Entrada dos dados EXERCICIO 8.23**

> dados=read.csv2("8.23.csv")

> dados

F1 F2 resp

1 A1 B1 35.2

2 A1 B1 36.0

3 A1 B1 35.0

4 A1 B1 35.4

5 A1 B2 32.8

6 A1 B2 34.6

7 A1 B2 36.7

8 A1 B2 35.2

9 A2 B1 34.7

10 A2 B1 36.3

11 A2 B1 35.1

12 A2 B1 36.4

13 A2 B2 28.6

14 A2 B2 31.1

15 A2 B2 29.0

16 A2 B2 28.6

17 A3 B1 33.8

18 A3 B1 29.4

19 A3 B1 28.8

20 A3 B1 29.2

21 A3 B2 30.8

22 A3 B2 31.4

23 A3 B2 32.8

24 A3 B2 31.3

>

> attach(dados)

> fat2.crd(F1,F2,resp, quali = c(TRUE,TRUE), mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1: F1

FACTOR 2: F2

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

F1 2 71.336 35.668 19.113 0.0000353

F2 1 20.907 20.907 11.203 0.0035876

F1\*F2 2 62.386 31.193 16.715 0.0000788

Residuals 18 33.590 1.866

Total 23 188.218

------------------------------------------------------------------------

CV = 4.16 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.07782912

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Significant interaction: analyzing the interaction

------------------------------------------------------------------------

Analyzing F1 inside of each level of F2

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F2 1 20.90667 20.90667 11.2033 0.0036

F2:F1 B1 2 72.55500 36.27750 19.4402 0

F2:F1 B2 2 61.16667 30.58333 16.3888 1e-04

Residuals 18 33.59000 1.86611

Total 23 188.21833 8.18341

------------------------------------------------------------------------

F1 inside of the level B1 of F2

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 2 35.625

a 1 35.4

b 3 30.3

------------------------------------------------------------------------

F1 inside of the level B2 of F2

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 1 34.825

b 3 31.575

b 2 29.325

------------------------------------------------------------------------

Analyzing F2 inside of each level of F1

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F1 2 71.33583 35.66792 19.1135 0

F1:F2 A1 1 0.66125 0.66125 0.3543 0.5591

F1:F2 A2 1 79.38000 79.38000 42.5377 0

F1:F2 A3 1 3.25125 3.25125 1.7423 0.2034

Residuals 18 33.59000 1.86611

Total 23 188.21833 8.18341

------------------------------------------------------------------------

F2 inside of the level A1 of F1

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 35.400

2 2 34.825

------------------------------------------------------------------------

F2 inside of the level A2 of F1

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 1 35.625

b 2 29.325

------------------------------------------------------------------------

F2 inside of the level A3 of F1

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 30.300

2 2 31.575

------------------------------------------------------------------------

> fat2.crd(F1,F2,resp, quali = c(TRUE,TRUE), mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1: F1

FACTOR 2: F2

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

F1 2 71.336 35.668 19.113 0.0000353

F2 1 20.907 20.907 11.203 0.0035876

F1\*F2 2 62.386 31.193 16.715 0.0000788

Residuals 18 33.590 1.866

Total 23 188.218

------------------------------------------------------------------------

CV = 4.16 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.07782912

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Significant interaction: analyzing the interaction

------------------------------------------------------------------------

Analyzing F1 inside of each level of F2

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F2 1 20.90667 20.90667 11.2033 0.0036

F2:F1 B1 2 72.55500 36.27750 19.4402 0

F2:F1 B2 2 61.16667 30.58333 16.3888 1e-04

Residuals 18 33.59000 1.86611

Total 23 188.21833 8.18341

------------------------------------------------------------------------

F1 inside of the level B1 of F2

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 2 35.625

a 1 35.4

b 3 30.3

------------------------------------------------------------------------

F1 inside of the level B2 of F2

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 1 34.825

b 3 31.575

c 2 29.325

------------------------------------------------------------------------

Analyzing F2 inside of each level of F1

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F1 2 71.33583 35.66792 19.1135 0

F1:F2 A1 1 0.66125 0.66125 0.3543 0.5591

F1:F2 A2 1 79.38000 79.38000 42.5377 0

F1:F2 A3 1 3.25125 3.25125 1.7423 0.2034

Residuals 18 33.59000 1.86611

Total 23 188.21833 8.18341

------------------------------------------------------------------------

F2 inside of the level A1 of F1

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 35.400

2 2 34.825

------------------------------------------------------------------------

F2 inside of the level A2 of F1

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 1 35.625

b 2 29.325

------------------------------------------------------------------------

F2 inside of the level A3 of F1

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 30.300

2 2 31.575

------------------------------------------------------------------------

**# Entrada dos dados EXERCICIO 8.25**

> dados=read.csv2("8.25.csv")

> dados

F1 F2 resp

1 R1 E1 26.2

2 R1 E1 26.0

3 R1 E1 25.0

4 R1 E1 25.4

5 R1 E2 24.8

6 R1 E2 24.6

7 R1 E2 26.7

8 R1 E2 25.2

9 R2 E1 25.7

10 R2 E1 26.3

11 R2 E1 25.1

12 R2 E1 26.4

13 R2 E2 19.6

14 R2 E2 21.1

15 R2 E2 19.0

16 R2 E2 18.6

17 R3 E1 22.8

18 R3 E1 19.4

19 R3 E1 18.8

20 R3 E1 19.2

21 R3 E2 19.8

22 R3 E2 21.4

23 R3 E2 22.8

24 R3 E2 21.3

>

> attach(dados)

> fat2.crd(F1,F2,resp, quali = c(TRUE,TRUE), mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1: F1

FACTOR 2: F2

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

F1 2 92.861 46.430 36.195 0.00000049

F2 1 19.082 19.082 14.875 0.00115535

F1\*F2 2 63.761 31.880 24.853 0.00000664

Residuals 18 23.090 1.283

Total 23 198.793

------------------------------------------------------------------------

CV = 4.93 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.09401682

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Significant interaction: analyzing the interaction

------------------------------------------------------------------------

Analyzing F1 inside of each level of F2

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F2 1 19.08167 19.08167 14.8753 0.0012

F2:F1 E1 2 87.12167 43.56083 33.9582 0

F2:F1 E2 2 69.50000 34.75000 27.0896 0

Residuals 18 23.09000 1.28278

Total 23 198.79333 8.64319

------------------------------------------------------------------------

F1 inside of the level E1 of F2

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 2 25.875

a 1 25.65

b 3 20.05

------------------------------------------------------------------------

F1 inside of the level E2 of F2

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 1 25.325

b 3 21.325

b 2 19.575

------------------------------------------------------------------------

Analyzing F2 inside of each level of F1

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F1 2 92.86083 46.43042 36.1952 0

F1:F2 R1 1 0.21125 0.21125 0.1647 0.6897

F1:F2 R2 1 79.38000 79.38000 61.8813 0

F1:F2 R3 1 3.25125 3.25125 2.5345 0.1288

Residuals 18 23.09000 1.28278

Total 23 198.79333 8.64319

------------------------------------------------------------------------

F2 inside of the level R1 of F1

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 25.650

2 2 25.325

------------------------------------------------------------------------

F2 inside of the level R2 of F1

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a 1 25.875

b 2 19.575

------------------------------------------------------------------------

F2 inside of the level R3 of F1

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 20.050

2 2 21.325

------------------------------------------------------------------------

> fat2.crd(F1,F2,resp, quali = c(TRUE,TRUE), mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1: F1

FACTOR 2: F2

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

F1 2 92.861 46.430 36.195 0.00000049

F2 1 19.082 19.082 14.875 0.00115535

F1\*F2 2 63.761 31.880 24.853 0.00000664

Residuals 18 23.090 1.283

Total 23 198.793

------------------------------------------------------------------------

CV = 4.93 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.09401682

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

Significant interaction: analyzing the interaction

------------------------------------------------------------------------

Analyzing F1 inside of each level of F2

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F2 1 19.08167 19.08167 14.8753 0.0012

F2:F1 E1 2 87.12167 43.56083 33.9582 0

F2:F1 E2 2 69.50000 34.75000 27.0896 0

Residuals 18 23.09000 1.28278

Total 23 198.79333 8.64319

------------------------------------------------------------------------

F1 inside of the level E1 of F2

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 2 25.875

a 1 25.65

b 3 20.05

------------------------------------------------------------------------

F1 inside of the level E2 of F2

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 1 25.325

b 3 21.325

c 2 19.575

------------------------------------------------------------------------

Analyzing F2 inside of each level of F1

------------------------------------------------------------------------

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr.Fc

F1 2 92.86083 46.43042 36.1952 0

F1:F2 R1 1 0.21125 0.21125 0.1647 0.6897

F1:F2 R2 1 79.38000 79.38000 61.8813 0

F1:F2 R3 1 3.25125 3.25125 2.5345 0.1288

Residuals 18 23.09000 1.28278

Total 23 198.79333 8.64319

------------------------------------------------------------------------

F2 inside of the level R1 of F1

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 25.650

2 2 25.325

------------------------------------------------------------------------

F2 inside of the level R2 of F1

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a 1 25.875

b 2 19.575

------------------------------------------------------------------------

F2 inside of the level R3 of F1

According to the F test, the means of this factor are statistical equal.

Levels Means

1 1 20.050

2 2 21.325

------------------------------------------------------------------------

**Capítulo 9 - Experimentos em Parcelas Subdivididas**

**# Entrada dos dados EXERCICIO 9.1**

> dados=read.csv2("9.1.csv")

> dados

Bloco parcela subparc resp

1 1 A1 B1 42.9

2 1 A1 B2 53.8

3 1 A1 B3 49.5

4 1 A1 B4 44.4

5 2 A1 B1 41.6

6 2 A1 B2 58.5

7 2 A1 B3 53.8

8 2 A1 B4 41.8

9 3 A1 B1 28.9

10 3 A1 B2 43.9

11 3 A1 B3 40.7

12 3 A1 B4 28.3

13 4 A1 B1 30.8

14 4 A1 B2 46.3

15 4 A1 B3 39.4

16 4 A1 B4 34.7

17 1 A2 B1 53.3

18 1 A2 B2 57.6

19 1 A2 B3 59.8

20 1 A2 B4 64.1

21 2 A2 B1 69.6

22 2 A2 B2 69.6

23 2 A2 B3 65.8

24 2 A2 B4 57.4

25 3 A2 B1 45.4

26 3 A2 B2 42.4

27 3 A2 B3 41.4

28 3 A2 B4 44.1

29 4 A2 B1 35.1

30 4 A2 B2 51.9

31 4 A2 B3 45.4

32 4 A2 B4 51.6

33 1 A3 B1 62.3

34 1 A3 B2 63.4

35 1 A3 B3 64.5

36 1 A3 B4 63.6

37 2 A3 B1 58.5

38 2 A3 B2 50.4

39 2 A3 B3 46.1

40 2 A3 B4 56.1

41 3 A3 B1 44.6

42 3 A3 B2 45.0

43 3 A3 B3 62.6

44 3 A3 B4 52.7

45 4 A3 B1 50.3

46 4 A3 B2 46.7

47 4 A3 B3 50.3

48 4 A3 B4 51.8

49 1 A4 B1 75.4

50 1 A4 B2 70.3

51 1 A4 B3 68.8

52 1 A4 B4 71.6

53 2 A4 B1 65.6

54 2 A4 B2 67.3

55 2 A4 B3 65.3

56 2 A4 B4 69.4

57 3 A4 B1 54.0

58 3 A4 B2 57.6

59 3 A4 B3 45.6

60 3 A4 B4 56.6

61 4 A4 B1 52.7

62 4 A4 B2 58.5

63 4 A4 B3 51.0

64 4 A4 B4 47.4

> attach(dados)

> split2.rbd(parcela,subparc,Bloco,resp, quali = c(TRUE,TRUE), mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1 (plot): F1

FACTOR 2 (split-plot): F2

------------------------------------------------------------------------

------------------------------------------------------------------------

$`Analysis of Variance Table

------------------------------------------------------------------------

`

DF SS MS Fc Pr(>Fc)

F1 3 2848.0 949.34 13.8188 0.001022 \*\*

Block 3 2842.9 947.62 13.7938 0.001029 \*\*

Error a 9 618.3 68.70

F2 3 170.5 56.85 2.7987 0.053859 .

F1\*F2 9 586.5 65.16 3.2082 0.005945 \*\*

Error b 36 731.2 20.31

Total 63 7797.4

---

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

------------------------------------------------------------------------

CV 1 = 15.69515 %

CV 2 = 8.534077 %

Significant interaction: analyzing the interaction

------------------------------------------------------------------------

Analyzing F1 inside of each level of F2

------------------------------------------------------------------------

DF SS MS Fc p.value

F1 : F2 B1 3.00000 1404.1825 468.06083 14.442654 9e-06

F1 : F2 B2 3.00000 412.9700 137.65667 4.247584 0.014042

F1 : F2 B3 3.00000 324.7650 108.25500 3.340355 0.034095

F1 : F2 B4 3.00000 1292.5700 430.85667 13.294668 1.7e-05

Pooled Error 26.77883 867.8545 32.40823

------------------------------------------------------------------------

F1 inside of F2 B1

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a A4 61.925

ab A3 53.925

b A2 50.85

c A1 36.05

------------------------------------------------------------------------

F1 inside of F2 B2

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a A4 63.425

ab A2 55.375

b A3 51.375

b A1 50.625

------------------------------------------------------------------------

F1 inside of F2 B3

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a A4 57.675

ab A3 55.875

ab A2 53.1

b A1 45.85

------------------------------------------------------------------------

F1 inside of F2 B4

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a A4 61.25

a A3 56.05

a A2 54.3

b A1 37.3

------------------------------------------------------------------------

Analyzing F2 inside of each level of F1

------------------------------------------------------------------------

DF SS MS Fc p.value

F2 : F1 A1 3 583.49188 194.49729 9.575873 8.7e-05

F2 : F1 A2 3 45.21187 15.07062 0.741987 0.534047

F2 : F1 A3 3 56.95687 18.98562 0.934738 0.433943

F2 : F1 A4 3 71.34188 23.78063 1.170814 0.33435

Error b 36 731.20250 20.31118

------------------------------------------------------------------------

F2 inside of F1 A1

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a B2 50.625

ab B3 45.85

bc B4 37.3

c B1 36.05

------------------------------------------------------------------------

------------------------------------------------------------------------

F2 inside of F1 A2

------------------------------------------------------------------------

According to F test, the means of this factor are not different.

Levels Means

1 B1 50.850

2 B2 55.375

3 B3 53.100

4 B4 54.300

------------------------------------------------------------------------

F2 inside of F1 A3

------------------------------------------------------------------------

According to F test, the means of this factor are not different.

Levels Means

1 B1 53.925

2 B2 51.375

3 B3 55.875

4 B4 56.050

------------------------------------------------------------------------

F2 inside of F1 A4

------------------------------------------------------------------------

According to F test, the means of this factor are not different.

Levels Means

1 B1 61.925

2 B2 63.425

3 B3 57.675

4 B4 61.250

------------------------------------------------------------------------

> split2.rbd(parcela,subparc,Bloco,resp, quali = c(TRUE,TRUE), mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1 (plot): F1

FACTOR 2 (split-plot): F2

------------------------------------------------------------------------

------------------------------------------------------------------------

$`Analysis of Variance Table

------------------------------------------------------------------------

`

DF SS MS Fc Pr(>Fc)

F1 3 2848.0 949.34 13.8188 0.001022 \*\*

Block 3 2842.9 947.62 13.7938 0.001029 \*\*

Error a 9 618.3 68.70

F2 3 170.5 56.85 2.7987 0.053859 .

F1\*F2 9 586.5 65.16 3.2082 0.005945 \*\*

Error b 36 731.2 20.31

Total 63 7797.4

---

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

------------------------------------------------------------------------

CV 1 = 15.69515 %

CV 2 = 8.534077 %

Significant interaction: analyzing the interaction

------------------------------------------------------------------------

Analyzing F1 inside of each level of F2

------------------------------------------------------------------------

DF SS MS Fc p.value

F1 : F2 B1 3.00000 1404.1825 468.06083 14.442654 9e-06

F1 : F2 B2 3.00000 412.9700 137.65667 4.247584 0.014042

F1 : F2 B3 3.00000 324.7650 108.25500 3.340355 0.034095

F1 : F2 B4 3.00000 1292.5700 430.85667 13.294668 1.7e-05

Pooled Error 26.77883 867.8545 32.40823

------------------------------------------------------------------------

F1 inside of F2 B1

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a A4 61.925

ab A3 53.925

b A2 50.85

c A1 36.05

------------------------------------------------------------------------

F1 inside of F2 B2

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a A4 63.425

ab A2 55.375

b A3 51.375

b A1 50.625

------------------------------------------------------------------------

F1 inside of F2 B3

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a A4 57.675

a A3 55.875

ab A2 53.1

b A1 45.85

------------------------------------------------------------------------

F1 inside of F2 B4

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a A4 61.25

a A3 56.05

a A2 54.3

b A1 37.3

------------------------------------------------------------------------

Analyzing F2 inside of each level of F1

------------------------------------------------------------------------

DF SS MS Fc p.value

F2 : F1 A1 3 583.49188 194.49729 9.575873 8.7e-05

F2 : F1 A2 3 45.21187 15.07062 0.741987 0.534047

F2 : F1 A3 3 56.95687 18.98562 0.934738 0.433943

F2 : F1 A4 3 71.34188 23.78063 1.170814 0.33435

Error b 36 731.20250 20.31118

------------------------------------------------------------------------

F2 inside of F1 A1

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a B2 50.625

a B3 45.85

b B4 37.3

b B1 36.05

------------------------------------------------------------------------

------------------------------------------------------------------------

F2 inside of F1 A2

------------------------------------------------------------------------

According to F test, the means of this factor are not different.

Levels Means

1 B1 50.850

2 B2 55.375

3 B3 53.100

4 B4 54.300

------------------------------------------------------------------------

F2 inside of F1 A3

------------------------------------------------------------------------

According to F test, the means of this factor are not different.

Levels Means

1 B1 53.925

2 B2 51.375

3 B3 55.875

4 B4 56.050

------------------------------------------------------------------------

F2 inside of F1 A4

------------------------------------------------------------------------

According to F test, the means of this factor are not different.

Levels Means

1 B1 61.925

2 B2 63.425

3 B3 57.675

4 B4 61.250

------------------------------------------------------------------------

>

**# Entrada dos dados EXERCICIO 9.2**

> dados=read.csv2("9.2.csv")

> dados

Parc subp repet resp

1 A1 B1 1 18.0

2 A1 B1 2 17.5

3 A1 B1 3 17.8

4 A1 B2 1 17.1

5 A1 B2 2 18.8

6 A1 B2 3 16.9

7 A1 B3 1 17.6

8 A1 B3 2 18.1

9 A1 B3 3 17.6

10 A1 B4 1 17.6

11 A1 B4 2 17.2

12 A1 B4 3 16.5

13 A2 B1 1 16.3

14 A2 B1 2 16.6

15 A2 B1 3 15.0

16 A2 B2 1 15.9

17 A2 B2 2 14.3

18 A2 B2 3 14.0

19 A2 B3 1 16.5

20 A2 B3 2 16.3

21 A2 B3 3 15.9

22 A2 B4 1 18.3

23 A2 B4 2 17.5

24 A2 B4 3 15.2

25 A3 B1 1 16.0

26 A3 B1 2 19.5

27 A3 B1 3 16.3

28 A3 B2 1 16.2

29 A3 B2 2 14.9

30 A3 B2 3 16.4

31 A3 B3 1 17.9

32 A3 B3 2 15.0

33 A3 B3 3 16.0

34 A3 B4 1 16.1

35 A3 B4 2 15.3

36 A3 B4 3 16.4

37 A4 B1 1 16.6

38 A4 B1 2 15.9

39 A4 B1 3 17.5

40 A4 B2 1 15.2

41 A4 B2 2 13.2

42 A4 B2 3 15.8

43 A4 B3 1 14.2

44 A4 B3 2 18.0

45 A4 B3 3 16.7

46 A4 B4 1 15.5

47 A4 B4 2 17.3

48 A4 B4 3 18.4

49 A5 B1 1 18.9

50 A5 B1 2 18.5

51 A5 B1 3 21.5

52 A5 B2 1 18.6

53 A5 B2 2 13.7

54 A5 B2 3 16.4

55 A5 B3 1 15.3

56 A5 B3 2 18.2

57 A5 B3 3 18.3

58 A5 B4 1 17.0

59 A5 B4 2 18.3

60 A5 B4 3 16.6

>

> attach(dados)

> split2.crd(Parc,subp,repet,resp, quali = c(TRUE,TRUE), mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1 (plot): F1

FACTOR 2 (split-plot): F2

------------------------------------------------------------------------

------------------------------------------------------------------------

$`Analysis of Variance Table

------------------------------------------------------------------------

`

DF SS MS Fc Pr(>Fc)

F1 4 29.546 7.3864 4.7022 0.02149 \*

Error a 10 15.708 1.5708

F2 3 20.598 6.8659 3.9914 0.01666 \*

F1\*F2 12 20.120 1.6766 0.9747 0.49312

Error b 30 51.605 1.7202

Total 59 137.577

---

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

------------------------------------------------------------------------

CV 1 = 7.489267 %

CV 2 = 7.837176 %

No significant interaction: analyzing the simple effects

------------------------------------------------------------------------

F1

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a A5 17.60833

a A1 17.55833

a A3 16.33333

a A4 16.19167

a A2 15.98333

------------------------------------------------------------------------

F2

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a B1 17.46

ab B4 16.88

ab B3 16.77333

b B2 15.82667

------------------------------------------------------------------------

> split2.crd(Parc,subp,repet,resp, quali = c(TRUE,TRUE), mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1 (plot): F1

FACTOR 2 (split-plot): F2

------------------------------------------------------------------------

------------------------------------------------------------------------

$`Analysis of Variance Table

------------------------------------------------------------------------

`

DF SS MS Fc Pr(>Fc)

F1 4 29.546 7.3864 4.7022 0.02149 \*

Error a 10 15.708 1.5708

F2 3 20.598 6.8659 3.9914 0.01666 \*

F1\*F2 12 20.120 1.6766 0.9747 0.49312

Error b 30 51.605 1.7202

Total 59 137.577

---

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

------------------------------------------------------------------------

CV 1 = 7.489267 %

CV 2 = 7.837176 %

No significant interaction: analyzing the simple effects

------------------------------------------------------------------------

F1

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a A5 17.60833

a A1 17.55833

b A3 16.33333

b A4 16.19167

b A2 15.98333

------------------------------------------------------------------------

F2

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a B1 17.46

a B4 16.88

ab B3 16.77333

b B2 15.82667

------------------------------------------------------------------------

>

**# Entrada dos dados EXERCICIO 9.3**

> dados=read.csv2("9.3.csv")

> dados

bloco parc subp resp

1 1 A0 cova 3778

2 1 A0 sulco 3467

3 1 A0 lanço 3422

4 2 A0 cova 3618

5 2 A0 sulco 4284

6 2 A0 lanço 3760

7 3 A0 cova 2164

8 3 A0 sulco 3773

9 3 A0 lanço 2747

10 4 A0 cova 3996

11 4 A0 sulco 3280

12 4 A0 lanço 2853

13 1 A40 cova 3302

14 1 A40 sulco 3653

15 1 A40 lanço 3711

16 2 A40 cova 2671

17 2 A40 sulco 2653

18 2 A40 lanço 3284

19 3 A40 cova 2782

20 3 A40 sulco 3529

21 3 A40 lanço 2556

22 4 A40 cova 2502

23 4 A40 sulco 2258

24 4 A40 lanço 3284

25 1 A80 cova 2938

26 1 A80 sulco 3800

27 1 A80 lanço 2702

28 2 A80 cova 2813

29 2 A80 sulco 4356

30 2 A80 lanço 3520

31 3 A80 cova 2560

32 3 A80 sulco 3560

33 3 A80 lanço 3382

34 4 A80 cova 3049

35 4 A80 sulco 4013

36 4 A80 lanço 3524

37 1 A120 cova 3013

38 1 A120 sulco 3338

39 1 A120 lanço 3156

40 2 A120 cova 3787

41 2 A120 sulco 3369

42 2 A120 lanço 4369

43 3 A120 cova 3142

44 3 A120 sulco 2507

45 3 A120 lanço 2831

46 4 A120 cova 3604

47 4 A120 sulco 4200

48 4 A120 lanço 4222

>

> attach(dados)

> split2.rbd(parc,subp,bloco,resp, quali = c(TRUE,TRUE), mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1 (plot): F1

FACTOR 2 (split-plot): F2

------------------------------------------------------------------------

------------------------------------------------------------------------

$`Analysis of Variance Table

------------------------------------------------------------------------

`

DF SS MS Fc Pr(>Fc)

F1 3 1505020 501673 1.1687 0.37443

Block 3 2217357 739119 1.7218 0.23175

Error a 9 3863381 429265

F2 2 1256791 628395 3.5782 0.04365 \*

F1\*F2 6 2193304 365551 2.0815 0.09338 .

Error b 24 4214854 175619

Total 47 15250708

---

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

------------------------------------------------------------------------

CV 1 = 19.76891 %

CV 2 = 12.64462 %

No significant interaction: analyzing the simple effects

------------------------------------------------------------------------

F1

According to F test, the means of this factor are not different.

Levels Means

1 A0 3428.500

2 A120 3461.500

3 A40 3015.417

4 A80 3351.417

------------------------------------------------------------------------

F2

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a sulco 3502.5

ab lanço 3332.688

b cova 3107.438

------------------------------------------------------------------------

> split2.rbd(parc,subp,bloco,resp, quali = c(TRUE,TRUE), mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1 (plot): F1

FACTOR 2 (split-plot): F2

------------------------------------------------------------------------

------------------------------------------------------------------------

$`Analysis of Variance Table

------------------------------------------------------------------------

`

DF SS MS Fc Pr(>Fc)

F1 3 1505020 501673 1.1687 0.37443

Block 3 2217357 739119 1.7218 0.23175

Error a 9 3863381 429265

F2 2 1256791 628395 3.5782 0.04365 \*

F1\*F2 6 2193304 365551 2.0815 0.09338 .

Error b 24 4214854 175619

Total 47 15250708

---

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

------------------------------------------------------------------------

CV 1 = 19.76891 %

CV 2 = 12.64462 %

No significant interaction: analyzing the simple effects

------------------------------------------------------------------------

F1

According to F test, the means of this factor are not different.

Levels Means

1 A0 3428.500

2 A120 3461.500

3 A40 3015.417

4 A80 3351.417

------------------------------------------------------------------------

F2

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a sulco 3502.5

ab lanço 3332.688

b cova 3107.438

------------------------------------------------------------------------

**# Entrada dos dados EXERCICIO 9.8**

> dados=read.csv2("9.8.csv")

> dados

bloco parc subp resp

1 1 A1 B1 58

2 2 A1 B1 77

3 3 A1 B1 38

4 4 A1 B1 52

5 1 A1 B2 44

6 2 A1 B2 59

7 3 A1 B2 30

8 4 A1 B2 34

9 1 A2 B1 85

10 2 A2 B1 90

11 3 A2 B1 73

12 4 A2 B1 77

13 1 A2 B2 59

14 2 A2 B2 68

15 3 A2 B2 45

16 4 A2 B2 55

17 1 A3 B1 66

18 2 A3 B1 93

19 3 A3 B1 67

20 4 A3 B1 64

21 1 A3 B2 54

22 2 A3 B2 75

23 3 A3 B2 53

24 4 A3 B2 48

>

> attach(dados)

> split2.rbd(parc,subp,bloco,resp, quali = c(TRUE,TRUE), mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1 (plot): F1

FACTOR 2 (split-plot): F2

------------------------------------------------------------------------

------------------------------------------------------------------------

$`Analysis of Variance Table

------------------------------------------------------------------------

`

DF SS MS Fc Pr(>Fc)

F1 2 1792 896.00 16.800 0.003478 \*\*

Block 3 2352 784.00 14.700 0.003584 \*\*

Error a 6 320 53.33

F2 1 1944 1944.00 306.947 < 2.2e-16 \*\*\*

F1\*F2 2 127 63.50 10.026 0.005126 \*\*

Error b 9 57 6.33

Total 23 6592

---

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

------------------------------------------------------------------------

CV 1 = 11.97208 %

CV 2 = 4.125593 %

Significant interaction: analyzing the interaction

------------------------------------------------------------------------

Analyzing F1 inside of each level of F2

------------------------------------------------------------------------

DF SS MS Fc p.value

F1 : F2 B1 2.000000 1287.5000 643.75000 21.578213 8e-04

F1 : F2 B2 2.000000 631.5000 315.75000 10.583799 0.006671

Pooled Error 7.439669 221.9501 29.83333

------------------------------------------------------------------------

F1 inside of F2 B1

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a A2 81.25

a A3 72.5

b A1 56.25

------------------------------------------------------------------------

F1 inside of F2 B2

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a A3 57.5

a A2 56.75

b A1 41.75

------------------------------------------------------------------------

Analyzing F2 inside of each level of F1

------------------------------------------------------------------------

DF SS MS Fc p.value

F2 : F1 A1 1 420.5 420.500000 66.39474 1.9e-05

F2 : F1 A2 1 1200.5 1200.500000 189.552642 0

F2 : F1 A3 1 450.0 450.000000 71.052635 1.5e-05

Error b 9 57.0 6.333333

------------------------------------------------------------------------

F2 inside of F1 A1

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a B1 56.25

b B2 41.75

------------------------------------------------------------------------

------------------------------------------------------------------------

F2 inside of F1 A2

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a B1 81.25

b B2 56.75

------------------------------------------------------------------------

------------------------------------------------------------------------

F2 inside of F1 A3

------------------------------------------------------------------------

Tukey's test

------------------------------------------------------------------------

Groups Treatments Means

a B1 72.5

b B2 57.5

------------------------------------------------------------------------

------------------------------------------------------------------------

> split2.rbd(parc,subp,bloco,resp, quali = c(TRUE,TRUE), mcomp='duncan', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Legend:

FACTOR 1 (plot): F1

FACTOR 2 (split-plot): F2

------------------------------------------------------------------------

------------------------------------------------------------------------

$`Analysis of Variance Table

------------------------------------------------------------------------

`

DF SS MS Fc Pr(>Fc)

F1 2 1792 896.00 16.800 0.003478 \*\*

Block 3 2352 784.00 14.700 0.003584 \*\*

Error a 6 320 53.33

F2 1 1944 1944.00 306.947 < 2.2e-16 \*\*\*

F1\*F2 2 127 63.50 10.026 0.005126 \*\*

Error b 9 57 6.33

Total 23 6592

---

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

------------------------------------------------------------------------

CV 1 = 11.97208 %

CV 2 = 4.125593 %

Significant interaction: analyzing the interaction

------------------------------------------------------------------------

Analyzing F1 inside of each level of F2

------------------------------------------------------------------------

DF SS MS Fc p.value

F1 : F2 B1 2.000000 1287.5000 643.75000 21.578213 8e-04

F1 : F2 B2 2.000000 631.5000 315.75000 10.583799 0.006671

Pooled Error 7.439669 221.9501 29.83333

------------------------------------------------------------------------

F1 inside of F2 B1

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a A2 81.25

a A3 72.5

b A1 56.25

------------------------------------------------------------------------

F1 inside of F2 B2

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a A3 57.5

a A2 56.75

b A1 41.75

------------------------------------------------------------------------

Analyzing F2 inside of each level of F1

------------------------------------------------------------------------

DF SS MS Fc p.value

F2 : F1 A1 1 420.5 420.500000 66.39474 1.9e-05

F2 : F1 A2 1 1200.5 1200.500000 189.552642 0

F2 : F1 A3 1 450.0 450.000000 71.052635 1.5e-05

Error b 9 57.0 6.333333

------------------------------------------------------------------------

F2 inside of F1 A1

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a B1 56.25

b B2 41.75

------------------------------------------------------------------------

------------------------------------------------------------------------

F2 inside of F1 A2

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a B1 81.25

b B2 56.75

------------------------------------------------------------------------

------------------------------------------------------------------------

F2 inside of F1 A3

------------------------------------------------------------------------

Duncan's test

------------------------------------------------------------------------

Groups Treatments Means

a B1 72.5

b B2 57.5

------------------------------------------------------------------------

------------------------------------------------------------------------

**Capítulo 10 – Regressão**

**# Entrada dos dados EXERCICIO 10.1**

> rm(list=ls(all=TRUE)) # remover objetos anteriores

> dados=read.csv2("10.1.csv")

> dados

X Y

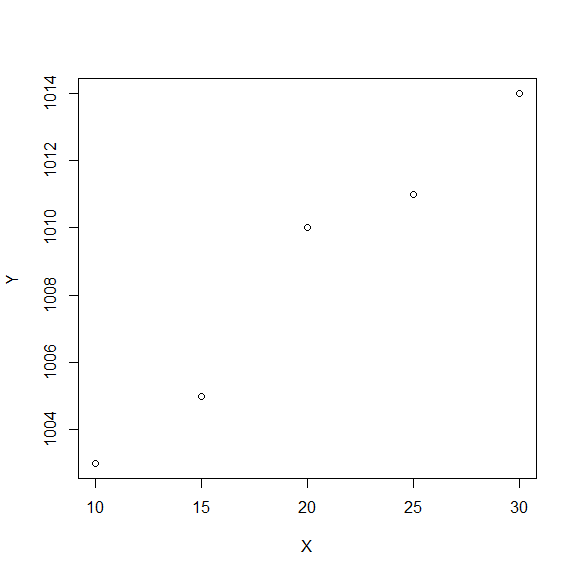
1 10 1003

2 15 1005

3 20 1010

4 25 1011

5 30 1014

> attach(dados)

>

> # diagrama de dispeção

>

> plot(X,Y)

# variável indep. deve vir primeiro

> # o diagrama sugere uma tendência

Linear dos dados. Então vamos montar

um modelo de regressão linear simples.

> reglin<-lm(Y~X) # lm = linear models

> reglin

Call:

lm(formula = Y ~ X)

Coefficients:

(Intercept) X

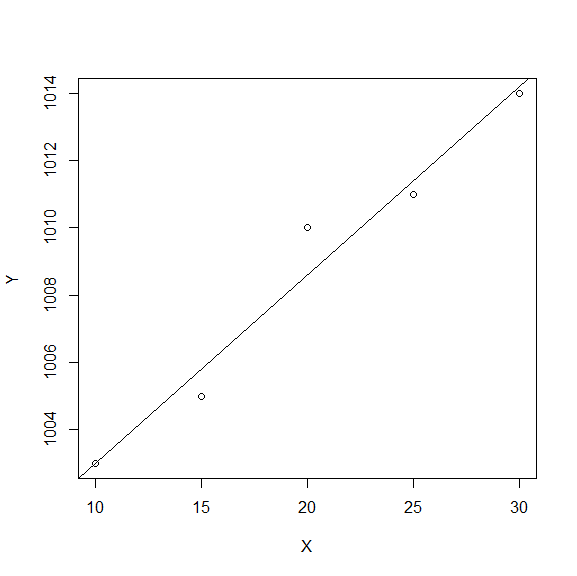
997.40 0.56

# Intercept = valor onde a reta de regressão intercepta o eixo das ordenadas, representa o beta0 (a contante de regresão).

# X = representa o Beta1 (coeficiente de regressão).

> predict (reglin) # preditos, valores ajustados de acordo com o modelo de regressão ajustado

1 2 3 4 5

1003.0 1005.8 1008.6 1011.4 1014.2

> plot(X,Y)

> abline(reglin)

# reta de regressão ajustada

> anova(reglin)

Analysis of Variance Table

Response: Y

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

X 1 78.4 78.400 84 0.002746 \*\*

Residuals 3 2.8 0.933

---

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

>

> summary(reglin)

Call:

lm(formula = Y ~ X)

Residuals:

1 2 3 4 5

7.414e-14 -8.000e-01 1.400e+00 -4.000e-01 -2.000e-01

Coefficients:

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

(Intercept) 997.4000 1.2961 769.511 4.84e-09 \*\*\*

X 0.5600 0.0611 9.165 0.00275 \*\*

---

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

Residual standard error: 0.9661 on 3 degrees of freedom

Multiple R-squared: 0.9655, Adjusted R-squared: 0.954

F-statistic: 84 on 1 and 3 DF, p-value: 0.002746

**# Entrada dos dados EXERCICIO 10.2**

**# Entrada dos dados EXERCICIO 10.3**

**# Entrada dos dados EXERCICIO 10.4**

**# Entrada dos dados EXERCICIO 10.5**

**# Entrada dos dados EXERCICIO 10.10**

**# Entrada dos dados EXERCICIO 10.12**

**# Entrada dos dados EXERCICIO 10.14**

> #################### Entrada dos dados EXERCICIO 10.14 ###

>

>

> rm(list=ls(all=TRUE))

> dados=read.csv2("10.14.csv")

> dados

trat resp

1 1 3

2 1 4

3 1 8

4 2 5

5 2 9

6 2 13

7 3 8

8 3 10

9 3 12

10 4 9

11 4 13

12 4 17

13 5 12

14 5 11

15 5 16

> attach(dados)

> # diagrama de dispeção

>

> plot(X,Y) # variável indep. deve vir primeiro

>

> # o diagrama sugere uma tendência quadrática dos dados.

>

> reglin<-lm(Y~X+I(X^2)) # modelo de regressão quadrática

> reglin

Call:

lm(formula = Y ~ X + I(X^2))

Coefficients:

(Intercept) X I(X^2)

995.400000 0.788571 -0.005714

>

> # Intercept = valor onde a reta de regressão intercepta o eixo das ordenadas, representa o beta0 (a contante de regresão).

> # X = representa neste caso o Beta1 (coeficiente de regressão).

> # I= representa beta2

>

> predict (reglin) # preditos, valores ajustados de acordo com o modelo de regressão ajustado

1 2 3 4 5

1002.714 1005.943 1008.886 1011.543 1013.914

> plot(X,Y)

> curve(16.1198+(-0.1600\*x)-0.9093\*x\*x,-4,14,add=T,pch=R4, col="red") # reta de regressão ajustada

Error in plot.xy(xy, type, ...) : object 'R4' not found

In addition: Warning message:

In curve(16.1198 + (-0.16 \* x) - 0.9093 \* x \* x, -4, 14, add = T, :

'add' will be ignored as there is no existing plot

>

>

>

> anova(reglin)

Analysis of Variance Table

Response: Y

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

X 1 78.400 78.400 62.3636 0.01566 \*

I(X^2) 1 0.286 0.286 0.2273 0.68056

Residuals 2 2.514 1.257

---

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

>

> summary(reglin)

Call:

lm(formula = Y ~ X + I(X^2))

Residuals:

1 2 3 4 5

0.28571 -0.94286 1.11429 -0.54286 0.08571

Coefficients:

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

(Intercept) 995.400000 4.456777 223.345 2e-05 \*\*\*

X 0.788571 0.484671 1.627 0.245

I(X^2) -0.005714 0.011986 -0.477 0.681

---

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

Residual standard error: 1.121 on 2 degrees of freedom

Multiple R-squared: 0.969, Adjusted R-squared: 0.9381

F-statistic: 31.3 on 2 and 2 DF, p-value: 0.03096

>

> #################### Entrada dos dados EXERCICIO 10.14 ###

>

>

> rm(list=ls(all=TRUE))

> dados=read.csv2("10.14.csv")

> dados

trat resp

1 1 3

2 1 4

3 1 8

4 2 5

5 2 9

6 2 13

7 3 8

8 3 10

9 3 12

10 4 9

11 4 13

12 4 17

13 5 12

14 5 11

15 5 16

> attach(dados)

The following object is masked from dados (position 3):

resp, trat

The following object is masked from dados (position 5):

resp

The following object is masked from dados (position 6):

resp

The following object is masked from dados (position 7):

resp

The following object is masked from dados (position 8):

resp

The following object is masked from dados (position 10):

resp

>

> library(ExpDes)

> crd(trat,resp, quali = TRUE, mcomp='tukey', sigT = 0.05, sigF = 0.05)

------------------------------------------------------------------------

Analysis of Variance Table

------------------------------------------------------------------------

DF SS MS Fc Pr>Fc

Treatament 4 132 33 3.3 0.057205

Residuals 10 100 10

Total 14 232

------------------------------------------------------------------------

CV = 31.62 %

------------------------------------------------------------------------

Shapiro-Wilk normality test

p-value: 0.2409348

According to Shapiro-Wilk normality test at 5% of significance, residuals can be considered normal.

------------------------------------------------------------------------

According to the F test, the means can not be considered distinct.

Levels Means

1 1 5

2 2 9

3 3 10

4 4 13

5 5 13

------------------------------------------------------------------------

> reg.poly(resp, treat, DFResiduals, SSResiduals, MSTreatament, SSTreatament)

Error in reg.poly(resp, treat, DFResiduals, SSResiduals, MSTreatament, :

object 'SSResiduals' not found

>

>

> anova(reglin)

Error in anova(reglin) : object 'reglin' not found

>

> summary(reglin)

Error in summary(reglin) : object 'reglin' not found

>

>