**Example**

**Data Set**

ordinal\_1 ordinal\_2 numeric dup\_female dup\_male dup\_all ID

246 5 3 600 1 0 1 1

250 5 3 700 0 1 1 2

258 5 3 1200 0 1 1 3

259 5 3 1300 1 0 1 4

321 1 1 62 0 0 0 5

322 6 8 60000 0 0 0 6

(im Split B ist das minimale Element 62, wenn man sich das Ganze aber ohne den Split ansieht, ohne löschen von Zeilen mit Nas, dann kommt man auf die 37, die beiden min und max kamen nie vor)

**Die Constraint-Matrix (ohne Anpassung an xi, Permutationstest, IP, Regularisierung)**

R1

[,1] [,2] [,3] [,4] [,5] [,6]

[1,] 1 0 0 0 -1 0

[2,] 0 1 0 0 -1 0

[3,] 0 0 1 0 -1 0

[4,] 0 0 0 1 -1 0

[5,] 0 0 0 0 -1 1

[6,] -1 1 0 0 0 0

[7,] -1 0 1 0 0 0

[8,] -1 0 0 1 0 0

[9,] -1 0 0 0 0 1

[10,] 0 -1 1 0 0 0

[11,] 0 -1 0 1 0 0

[12,] 0 -1 0 0 0 1

[13,] 0 0 -1 1 0 0

[14,] 0 0 -1 0 0 1

[15,] 0 0 0 -1 0 1

Der df\_r1\_values output (die Paare aus R1)

ID\_lower ID\_upper ordinal\_1\_lower ordinal\_2\_lower ordinal\_1\_upper ordinal\_2\_upper difference\_numeric

1 5 1 1 1 5 3 538

2 5 2 1 1 5 3 638

3 5 3 1 1 5 3 1138

4 5 4 1 1 5 3 1238

5 5 6 1 1 6 8 59938

6 1 2 5 3 5 3 100

7 1 3 5 3 5 3 600

8 1 4 5 3 5 3 700

9 1 6 5 3 6 8 59400

10 2 3 5 3 5 3 500

11 2 4 5 3 5 3 600

12 2 6 5 3 6 8 59300

13 3 4 5 3 5 3 100

14 3 6 5 3 6 8 58800

15 4 6 5 3 6 8 58700

R2

[,1] [,2] [,3] [,4] [,5] [,6]

[1,] 1 0 -1 1 -1 0

[2,] 0 1 -1 1 -1 0

[3,] 1 -1 0 1 -1 0

[4,] 1 0 1 -1 -1 0

[5,] 0 1 1 -1 -1 0

[6,] 1 -1 1 0 -1 0

[7,] 0 0 2 -1 -1 0

[8,] 1 1 -1 0 -1 0

[9,] 0 2 0 -1 -1 0

[10,] 0 2 -1 0 -1 0

[11,] 0 1 1 -1 -1 0

[12,] 1 1 -1 0 -1 0

[13,] 2 -1 0 0 -1 0

[14,] 1 0 1 -1 -1 0

[15,] 1 0 0 -1 -1 1

[16,] 1 0 -1 0 -1 1

[17,] 0 1 0 -1 -1 1

[18,] 0 1 -1 0 -1 1

[19,] 1 -1 0 0 -1 1

[20,] 0 0 1 -1 -1 1

[21,] -1 1 -1 1 0 0

[22,] -1 1 1 -1 0 0

[23,] -1 0 2 -1 0 0

[24,] 1 -1 -1 1 0 0

[25,] 1 -2 0 1 0 0

[26,] 1 -2 1 0 0 0

[27,] 0 -1 2 -1 0 0

[28,] -1 1 1 -1 0 0

[29,] 1 -1 -1 1 0 0

[30,] -1 1 0 -1 0 1

[31,] -1 1 -1 0 0 1

[32,] -1 0 1 -1 0 1

[33,] 1 -1 0 -1 0 1

[34,] 1 -1 -1 0 0 1

[35,] 1 -2 0 0 0 1

[36,] 0 -1 1 -1 0 1

[37,] 1 0 -1 -1 0 1

[38,] 1 0 -2 0 0 1

[39,] 0 1 -1 -1 0 1

[40,] 0 1 -2 0 0 1

[41,] 1 -1 -1 0 0 1

[42,] 1 0 0 -2 0 1

[43,] 1 0 -1 -1 0 1

[44,] 0 1 0 -2 0 1

[45,] 0 1 -1 -1 0 1

[46,] 1 -1 0 -1 0 1

Gleichheitsconstraints in R2 bei den Reihen

22 24 28 29

**Modell zur Berechnung von xi**

Lineares Programm das maximiert wird.

Zielfunktion

0 0 0 0 0 0 1

Die Constraint Matrix (die 8 Spalte entspricht dem xi constraint, der Rest kopiert von R1 und R2)

[,1] [,2] [,3] [,4] [,5] [,6] [,7]

[1,] 1 0 0 0 -1 0 -1

[2,] 0 1 0 0 -1 0 -1

[3,] 0 0 1 0 -1 0 -1

[4,] 0 0 0 1 -1 0 -1

[5,] 0 0 0 0 -1 1 -1

[6,] -1 1 0 0 0 0 -1

[7,] -1 0 1 0 0 0 -1

[8,] -1 0 0 1 0 0 -1

[9,] -1 0 0 0 0 1 -1

[10,] 0 -1 1 0 0 0 -1

[11,] 0 -1 0 1 0 0 -1

[12,] 0 -1 0 0 0 1 -1

[13,] 0 0 -1 1 0 0 -1

[14,] 0 0 -1 0 0 1 -1

[15,] 0 0 0 -1 0 1 -1

[16,] 1 0 -1 1 -1 0 -1

[17,] 0 1 -1 1 -1 0 -1

[18,] 1 -1 0 1 -1 0 -1

[19,] 1 0 1 -1 -1 0 -1

[20,] 0 1 1 -1 -1 0 -1

[21,] 1 -1 1 0 -1 0 -1

[22,] 0 0 2 -1 -1 0 -1

[23,] 1 1 -1 0 -1 0 -1

[24,] 0 2 0 -1 -1 0 -1

[25,] 0 2 -1 0 -1 0 -1

[26,] 0 1 1 -1 -1 0 -1

[27,] 1 1 -1 0 -1 0 -1

[28,] 2 -1 0 0 -1 0 -1

[29,] 1 0 1 -1 -1 0 -1

[30,] 1 0 0 -1 -1 1 -1

[31,] 1 0 -1 0 -1 1 -1

[32,] 0 1 0 -1 -1 1 -1

[33,] 0 1 -1 0 -1 1 -1

[34,] 1 -1 0 0 -1 1 -1

[35,] 0 0 1 -1 -1 1 -1

[36,] -1 1 -1 1 0 0 -1

[37,] -1 1 1 -1 0 0 0

[38,] -1 0 2 -1 0 0 -1

[39,] 1 -1 -1 1 0 0 0

[40,] 1 -2 0 1 0 0 -1

[41,] 1 -2 1 0 0 0 -1

[42,] 0 -1 2 -1 0 0 -1

[43,] -1 1 1 -1 0 0 0

[44,] 1 -1 -1 1 0 0 0

[45,] -1 1 0 -1 0 1 -1

[46,] -1 1 -1 0 0 1 -1

[47,] -1 0 1 -1 0 1 -1

[48,] 1 -1 0 -1 0 1 -1

[49,] 1 -1 -1 0 0 1 -1

[50,] 1 -2 0 0 0 1 -1

[51,] 0 -1 1 -1 0 1 -1

[52,] 1 0 -1 -1 0 1 -1

[53,] 1 0 -2 0 0 1 -1

[54,] 0 1 -1 -1 0 1 -1

[55,] 0 1 -2 0 0 1 -1

[56,] 1 -1 -1 0 0 1 -1

[57,] 1 0 0 -2 0 1 -1

[58,] 1 0 -1 -1 0 1 -1

[59,] 0 1 0 -2 0 1 -1

[60,] 0 1 -1 -1 0 1 -1

[61,] 1 -1 0 -1 0 1 -1

[62,] 0 0 1 -2 0 1 -1

Die rechte Seite des Constraints

[1] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

[46] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

Rechte und linke des Constraints werden zusammengesetzt mit

[1] ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">"

[23] ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" "=" ">" "=" ">" ">" ">" "=" "="

[45] ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">"

Lower bounds für die Variablen in der Zielfunktion

[1] 0 0 0 0 0 1 0

Upper bounds für die Variablen in der Zielfuntion

[1] 1 1 1 1 0 1 1

* Ergebnis: xi = 0.083333333

**Berechnung des Permutationstests**

Lineare Programme die minimiert werden

Der folgende Teil gilt für alle Tests: (inkl. IP, nicht IP, regularisiert, nicht regularisiert)

Eps <- 0.001

Gamma <- 0.01

Constraint Matrix

[,1] [,2] [,3] [,4] [,5] [,6]

[1,] 1 0 0 0 -1 0

[2,] 0 1 0 0 -1 0

[3,] 0 0 1 0 -1 0

[4,] 0 0 0 1 -1 0

[5,] 0 0 0 0 -1 1

[6,] -1 1 0 0 0 0

[7,] -1 0 1 0 0 0

[8,] -1 0 0 1 0 0

[9,] -1 0 0 0 0 1

[10,] 0 -1 1 0 0 0

[11,] 0 -1 0 1 0 0

[12,] 0 -1 0 0 0 1

[13,] 0 0 -1 1 0 0

[14,] 0 0 -1 0 0 1

[15,] 0 0 0 -1 0 1

[16,] 1 0 -1 1 -1 0

[17,] 0 1 -1 1 -1 0

[18,] 1 -1 0 1 -1 0

[19,] 1 0 1 -1 -1 0

[20,] 0 1 1 -1 -1 0

[21,] 1 -1 1 0 -1 0

[22,] 0 0 2 -1 -1 0

[23,] 1 1 -1 0 -1 0

[24,] 0 2 0 -1 -1 0

[25,] 0 2 -1 0 -1 0

[26,] 0 1 1 -1 -1 0

[27,] 1 1 -1 0 -1 0

[28,] 2 -1 0 0 -1 0

[29,] 1 0 1 -1 -1 0

[30,] 1 0 0 -1 -1 1

[31,] 1 0 -1 0 -1 1

[32,] 0 1 0 -1 -1 1

[33,] 0 1 -1 0 -1 1

[34,] 1 -1 0 0 -1 1

[35,] 0 0 1 -1 -1 1

[36,] -1 1 -1 1 0 0

[37,] -1 1 1 -1 0 0

[38,] -1 0 2 -1 0 0

[39,] 1 -1 -1 1 0 0

[40,] 1 -2 0 1 0 0

[41,] 1 -2 1 0 0 0

[42,] 0 -1 2 -1 0 0

[43,] -1 1 1 -1 0 0

[44,] 1 -1 -1 1 0 0

[45,] -1 1 0 -1 0 1

[46,] -1 1 -1 0 0 1

[47,] -1 0 1 -1 0 1

[48,] 1 -1 0 -1 0 1

[49,] 1 -1 -1 0 0 1

[50,] 1 -2 0 0 0 1

[51,] 0 -1 1 -1 0 1

[52,] 1 0 -1 -1 0 1

[53,] 1 0 -2 0 0 1

[54,] 0 1 -1 -1 0 1

[55,] 0 1 -2 0 0 1

[56,] 1 -1 -1 0 0 1

[57,] 1 0 0 -2 0 1

[58,] 1 0 -1 -1 0 1

[59,] 0 1 0 -2 0 1

[60,] 0 1 -1 -1 0 1

[61,] 1 -1 0 -1 0 1

[62,] 0 0 1 -2 0 1

Rechte und linke des Constraints werden verglichen mit

[1] ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">"

[23] ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" "=" ">" "=" ">" ">" ">" "=" "="

[45] ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">" ">"

Lower bounds für die Variablen in der Zielfunktion

[1] 0 0 0 0 0 1

Upper bounds für die Variablen in der Zielfuntion

[1] 1 1 1 1 0 1

Nicht regularisiert -> eps = 0

Der nächste Teil: nur für nicht regularisiert und keine IP (unter Anwendung der Aufteilung des Datensatzes wie oben -> also noch keine Permutation hier)

Rechte Seite von der Constraint Matrix

[1] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

[46] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

Die Zielfunktion

[1] 0.25 -0.25 -0.25 0.25 0.00 0.00

* Ergebnis: 0 und die x Werte dazu

[1] 0.0002500000 0.0003333333 0.0005000000 0.0005833333 0.0000000000 1.0000000000

Der nächste Teil: nur für regularisiert und keine IP (unter Anwendung der Aufteilung des Datensatzes wie oben -> also noch keine Permutation hier)

Rechte Seite von der Constraint Matrix

[1] 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[7] 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[13] 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[19] 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[25] 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[31] 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[37] 0.000000e+00 8.333333e-05 0.000000e+00 8.333333e-05 8.333333e-05 8.333333e-05

[43] 0.000000e+00 0.000000e+00 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[49] 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[55] 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[61] 8.333333e-05 8.333333e-05

Die Zielfunktion

[1] 0.25 -0.25 -0.25 0.25 0.00 0.00

* Ergebnis: 0 und die x Werte dazu

[1] 0.1557143 0.2914286 0.4371429 0.5728571 0.0000000 1.0000000

Der nächste Teil: nur für nicht regularisiert unter IP (unter Anwendung der Aufteilung des Datensatzes wie oben -> also noch keine Permutation hier)

Rechte Seite von der Constraint Matrix

[1] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

[46] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

Die Zielfunktion

[1] 0.2475 -0.2475 -0.2475 0.2475 -0.0100 0.0100

* Ergebnis 0.01 und die x Werte dazu

[1] 0.0002500000 0.0003333333 0.0005000000 0.0005833333 0.0000000000 1.0000000000

Der nächste Teil: nur für regularisiert und IP (unter Anwendung der Aufteilung des Datensatzes wie oben -> also noch keine Permutation hier)

Rechte Seite von der Constraint Matrix

[1] 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[7] 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[13] 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[19] 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[25] 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[31] 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[37] 0.000000e+00 8.333333e-05 0.000000e+00 8.333333e-05 8.333333e-05 8.333333e-05

[43] 0.000000e+00 0.000000e+00 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[49] 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[55] 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05 8.333333e-05

[61] 8.333333e-05 8.333333e-05

Die Zielfunktion

[1] 0.2475 -0.2475 -0.2475 0.2475 -0.0100 0.0100

* Ergebnis: 0.01

[1] 0.1557143 0.2914286 0.4371429 0.5728571 0.0000000 1.0000000

**Ein Beispiel für die permutierten Daten ist hier:**

ordinal\_1 ordinal\_2 numeric dup\_female dup\_male dup\_all ID

246 5 3 600 1 0 1 1

250 5 3 700 0 1 1 2

258 5 3 1200 1 0 1 3

259 5 3 1300 0 1 1 4

321 1 1 62 0 0 0 5

322 6 8 60000 0 0 0 6