A07 Hoermann

Aufgabe 07

a)

- n ... index
- p, e ... regressors (independent variables)
- s, v, d ... dependent variables

```
df = read.csv("regr.csv")
cor(df)
```

```
##              n           p          e           s           v           d
## n  1.000000000 0.005942531 0.00559404 -0.01367667 -0.03169528 0.008111184
## p  0.005942531 1.000000000 0.07811189  0.89399345  0.88275842 0.699126301
## e  0.005594040 0.078111892 1.00000000  0.50275362  0.48441650 0.761721139
## s -0.013676667 0.893993454 0.50275362  1.00000000  0.99398317 0.930266958
## v -0.031695282 0.882758416 0.48441650  0.99398317  1.00000000 0.907741943
## d  0.008111184 0.699126301 0.76172114  0.93026696  0.90774194 1.000000000
```

Interpretation

There is a strong correlation between v & s, d & s, v & d and d & e.

```
Regr = lm(df$s~df$p+df$e+I(df$p^2)+I(df$e^2)+I(df$p*df$e)+I(df$p^2*df$e)+I(df$p*df$e^2)-1)
summary(Regr)
```

```
##
## Call:
## lm(formula = df$s ~ df$p + df$e + I(df$p^2) + I(df$e^2) + I(df$p *
##     df$e) + I(df$p^2 * df$e) + I(df$p * df$e^2) - 1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.55295 -0.22161  0.01591  0.24363  0.48227
##
## Coefficients:
##                    Estimate Std. Error t value Pr(>|t|)
## df$p               -0.476346   0.408135  -1.167    0.246
## df$e                0.190604   0.222278   0.858    0.393
## I(df$p^2)           6.358917   0.082726  76.867   <2e-16 ***
## I(df$e^2)          -0.022992   0.019333  -1.189    0.237
## I(df$p * df$e)      6.308444   0.034458 183.074   <2e-16 ***
## I(df$p^2 * df$e) -0.008824   0.007946  -1.110    0.270
## I(df$p * df$e^2)  0.003813   0.004287   0.889    0.376
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2932 on 93 degrees of freedom
## Multiple R-squared:      1,  Adjusted R-squared:      1
## F-statistic: 3.702e+07 on 7 and 93 DF,  p-value: < 2.2e-16
```

```r
Regr2 = lm(df$s~df$p+I(df$e^2)+I(df$p*df$e)+I(df$p^2*df$e)+I(df$p*df$e^2)-1)
summary(Regr2)
```

```
##
## Call:
## lm(formula = df$s ~ df$p + I(df$e^2) + I(df$p * df$e) + I(df$p^2 *
##     df$e) + I(df$p * df$e^2) - 1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -16.9267  -2.4017   0.9328   2.2703  24.0547
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## df$p              29.44608    1.82612  16.125  < 2e-16 ***
## I(df$e^2)          0.41059    0.07781   5.277 8.27e-07 ***
## I(df$p * df$e)     2.88667    0.40342   7.155 1.73e-10 ***
## I(df$p^2 * df$e)   0.76692    0.03347  22.914  < 2e-16 ***
## I(df$p * df$e^2) -0.10846    0.02431  -4.462 2.23e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.279 on 95 degrees of freedom
## Multiple R-squared:  0.9999, Adjusted R-squared:  0.9999
## F-statistic: 1.599e+05 on 5 and 95 DF,  p-value: < 2.2e-16
```

```r
df = read.csv("regr2.csv")
cor(df)
```

```
##              n           p          e           s           v           d
## n  1.000000000 0.005942531 -0.0477928 -0.03476709 -0.05442709 -0.02247575
## p  0.005942531 1.000000000  0.8743364  0.97508578  0.94781179  0.96519940
## e -0.047792799 0.874336427  1.0000000  0.93820670  0.91350344  0.97062132
## s -0.034767093 0.975085781  0.9382067  1.00000000  0.99071976  0.98707027
## v -0.054427091 0.947811794  0.9135034  0.99071976  1.00000000  0.96015193
## d -0.022475749 0.965199396  0.9706213  0.98707027  0.96015193  1.00000000
```

```r
Regr = lm(df$s~df$p+df$e+I(df$p^2)+I(df$e^2)+I(df$p*df$e)+I(df$p^2*df$e)+I(df$p*df$e^2)-1)
summary(Regr)
```

```
##
## Call:
## lm(formula = df$s ~ df$p + df$e + I(df$p^2) + I(df$e^2) + I(df$p *
##     df$e) + I(df$p^2 * df$e) + I(df$p * df$e^2) - 1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.51346 -0.20094  0.03007  0.17331  0.58658
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## df$p              -2.44741    1.35656  -1.804   0.0744 .
## df$e               1.19858    0.65845   1.820   0.0719 .
## I(df$p^2)          6.69766    0.27300  24.533   <2e-16 ***
## I(df$e^2)         -0.14780    0.06966  -2.122   0.0365 *
```

```
## I(df$p * df$e)    6.38232    0.08480  75.261   <2e-16 ***
## I(df$p^2 * df$e) -0.05162    0.02604  -1.982   0.0504 .
## I(df$p * df$e^2)  0.02526    0.01252   2.017   0.0465 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2789 on 93 degrees of freedom
## Multiple R-squared:      1,  Adjusted R-squared:      1
## F-statistic: 4.379e+07 on 7 and 93 DF,  p-value: < 2.2e-16
```

```
Regr2 = lm(df$s~df$p+I(df$e^2)+I(df$p*df$e)+I(df$p^2*df$e)+I(df$p*df$e^2)-1)
summary(Regr2)
```

```
##
## Call:
## lm(formula = df$s ~ df$p + I(df$e^2) + I(df$p * df$e) + I(df$p^2 *
##     df$e) + I(df$p * df$e^2) - 1)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -4.3030 -1.2260 -0.6559  0.3506  8.4459
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## df$p               2.28210    0.78518   2.906  0.00455 **
## I(df$e^2)         -1.01613    0.11031  -9.212 7.99e-15 ***
## I(df$p * df$e)    11.04709    0.31995  34.527  < 2e-16 ***
## I(df$p^2 * df$e)   0.20797    0.04079   5.099 1.74e-06 ***
## I(df$p * df$e^2)  -0.08370    0.01785  -4.690 9.14e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 1.932 on 95 degrees of freedom
## Multiple R-squared:      1,  Adjusted R-squared:      1
## F-statistic: 1.278e+06 on 5 and 95 DF,  p-value: < 2.2e-16
```