AdvStDaAn, Worksheet, Week 2

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Contents

Exercise 1

```
path <- file.path('Datasets', 'sniffer.dat')
df <- read.table(path, header=TRUE)

summary(df)
```

Dataset loading and sanity check:

```
##    Temp.Tank        Temp.Gas       Vapor.Tank    Vapor.Dispensed
##  Min.   :31.00   Min.   :35.00   Min.   :2.590   Min.   :2.590
##  1st Qu.:37.00   1st Qu.:41.00   1st Qu.:3.290   1st Qu.:3.373
##  Median :60.00   Median :60.00   Median :4.285   Median :4.090
##  Mean   :57.91   Mean   :55.91   Mean   :4.422   Mean   :4.324
##  3rd Qu.:62.00   3rd Qu.:62.00   3rd Qu.:4.630   3rd Qu.:4.540
##  Max.   :92.00   Max.   :92.00   Max.   :7.450   Max.   :7.450
##        Y
##  Min.   :16.00
##  1st Qu.:23.75
##  Median :31.50
##  Mean   :31.12
##  3rd Qu.:34.50
##  Max.   :55.00
```

```
dim(df)
```

```
## [1] 32  5
```

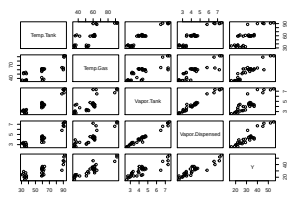
```
head(df)
```

```
##   Temp.Tank Temp.Gas Vapor.Tank Vapor.Dispensed  Y
## 1        33       53       3.32            3.42 29
## 2        31       36       3.10            3.26 24
## 3        33       51       3.18            3.18 26
## 4        37       51       3.39            3.08 22
## 5        36       54       3.20            3.41 27
## 6        35       35       3.03            3.03 21
```

```
tail(df)
```

```
##    Temp.Tank Temp.Gas Vapor.Tank Vapor.Dispensed  Y
## 27        60       62       4.02            3.89 33
## 28        59       62       3.98            4.02 27
## 29        59       62       4.39            4.53 34
## 30        37       35       2.75            2.64 19
## 31        35       35       2.59            2.59 16
## 32        37       37       2.73            2.59 22
```

```
plot(df)
```



Data looks like it is highly correlated with each other. But we keep it this way for the first exercises.

Exercise 1.a)

Fitting a first model without any transformations to the data:

```
lm1.1 <- lm(Y ~ ., data = df)
```

The model looks initially not too bad. For a proper evaluation one would need to perform a residual and sensitivity analysis to investigate the adequacy of the model. But for this exercise we keep the track of the worksheet.

E1.a)(I) Estimated coefficients

```
coef(lm1.1)
```

```
##     (Intercept)       Temp.Tank        Temp.Gas      Vapor.Tank Vapor.Dispensed
##      1.01501756     -0.02860886      0.21581693     -4.32005167      8.97488928
```

E1.a)(II) F-statistic

```
summary(lm1.1)
```

```
##
## Call:
## lm(formula = Y ~ ., data = df)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -5.586 -1.221 -0.118  1.320  5.106
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.01502    1.86131   0.545  0.59001
## Temp.Tank       -0.02861    0.09060  -0.316  0.75461
## Temp.Gas         0.21582    0.06772   3.187  0.00362 **
## Vapor.Tank      -4.32005    2.85097  -1.515  0.14132
## Vapor.Dispensed  8.97489    2.77263   3.237  0.00319 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.73 on 27 degrees of freedom
## Multiple R-squared:  0.9261, Adjusted R-squared:  0.9151
## F-statistic: 84.54 on 4 and 27 DF,  p-value: 7.249e-15
```

The p-value of the F-statistic is « 0.05 indicating that at least one of the variables can not be 0 and therfore are important to describe the response value. Even though, the p-values of the t-test indicate that not all of them are of the same importance. In this case are only 2 explanatory variables significantly important (Temp.Gas & Vapor.Dispensed). **E1.a)(III) Variance Inflation Factor (VIF)** Inspecting multicollinearity with the Variance Inflation Factor (VIF):

```
library(car)
```

```
## Loading required package: carData
```

```
vif(lm1.1)
```

```
##       Temp.Tank        Temp.Gas      Vapor.Tank Vapor.Dispensed
##       12.997379        4.720998       71.301491       61.932647
```

A vif above 5 to 10 indicates problems with multicollinearity. According to this guideline all variables but Temp.Gas have too high vif factors and therewith problems with multicollinearity. Vapor.Tank is affected the most.