Assignment 2

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Contents

```
knitr::opts_chunk$set(fig.width=6, fig.height=6)
```

1 Pre-requisite

1.1 install package

```
#install.packages("readxl")
#install.packages('dplyr')
```

1.2 load package

```
# Clear variables
rm(list=ls())

library(readxl)
library(dplyr)
library(tidyverse)
library(lattice)
library(leaps)
library(MASS)
```

1.3 Load dataset

```
# Load Dataset
dataset <- read_excel("dataset/Dataset2.xlsx")
```

2 Exploratory Data Analysis

Convert `Region` column data type to `factor`

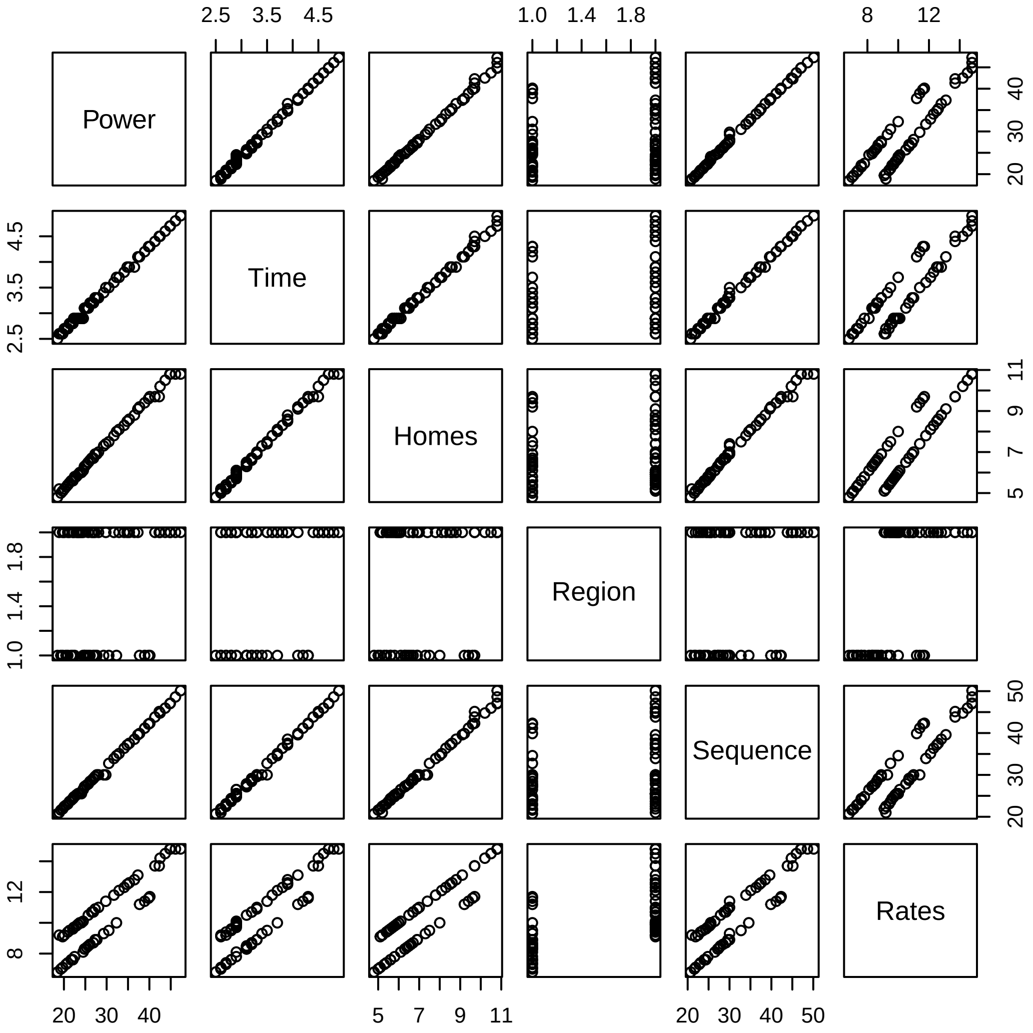
```
dataset$Region <- as.factor(dataset$Region)
```

2.1 Summary statistic

```
summary(dataset)
```

```
##      Power            Time           Homes         Region    Sequence    
##  Min.   :18.50   Min.   :2.500   Min.   : 4.800   1:24   Min.   :20.72  
##  1st Qu.:22.60   1st Qu.:2.900   1st Qu.: 5.800   2:34   1st Qu.:24.92  
##  Median :26.70   Median :3.200   Median : 6.700          Median :28.93  
##  Mean   :29.21   Mean   :3.405   Mean   : 7.226          Mean   :31.39  
##  3rd Qu.:35.17   3rd Qu.:3.900   3rd Qu.: 8.575          3rd Qu.:37.44  
##  Max.   :47.30   Max.   :4.900   Max.   :10.800          Max.   :50.12  
##      Rates      
##  Min.   : 6.80  
##  1st Qu.: 8.75  
##  Median : 9.95  
##  Mean   :10.40  
##  3rd Qu.:11.78  
##  Max.   :14.80  
```

```
plot(dataset)
```



[Interprating multidimention plot]

3 Model selection

3.1 Build the linear model

```
power_lm_model = lm(Power~ .,data=dataset)
summary(power_lm_model)
```

```
##
## Call:
## lm(formula = Power ~ ., data = dataset)
##
## Residuals:
```

```
##      Min       1Q   Median       3Q      Max
## -0.47230 -0.17587 -0.05152  0.08181  0.91553
##
## Coefficients: (1 not defined because of singularities)
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -3.46083    0.75232  -4.600 2.66e-05 ***
## Time         0.98145    0.96223   1.020    0.312
## Homes        1.70436    0.29075   5.862 3.00e-07 ***
## Region2      0.08236    0.07156   1.151    0.255
## Sequence     0.54034    0.06563   8.233 4.76e-11 ***
## Rates             NA         NA      NA       NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2609 on 53 degrees of freedom
## Multiple R-squared:  0.9991, Adjusted R-squared:  0.999
## F-statistic: 1.424e+04 on 4 and 53 DF,  p-value: < 2.2e-16
```

From the summary, Homes show coefficient of Rates are NA this means that it does not add any information to the model.

The following methods are used for model selection
1. Stepwise regression
2. Akaike information criterion (AIC)

3.2 Stepwise Regression

```
formula(power_lm_model)
```

```
## Power ~ Time + Homes + Region + Sequence + Rates
```

```
dataset1 = subset(dataset,select = -c(Rates))

power_lm_model =  lm(Power~ ., data=dataset1)
summary(power_lm_model)
```

```
##
## Call:
## lm(formula = Power ~ ., data = dataset1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.47230 -0.17587 -0.05152  0.08181  0.91553
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -3.46083    0.75232  -4.600 2.66e-05 ***
## Time         0.98145    0.96223   1.020    0.312
## Homes        1.70436    0.29075   5.862 3.00e-07 ***
## Region2      0.08236    0.07156   1.151    0.255
## Sequence     0.54034    0.06563   8.233 4.76e-11 ***
## ---
## Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1
##
## Residual standard error: 0.2609 on 53 degrees of freedom
## Multiple R-squared:  0.9991, Adjusted R-squared:  0.999
## F-statistic: 1.424e+04 on 4 and 53 DF,  p-value: < 2.2e-16
```

```
modelfoward =  stepAIC(power_lm_model,direction="forward",trace = FALSE)
step(modelfoward)
```

```
## Start:  AIC=-151.08
## Power ~ Time + Homes + Region + Sequence
##
##            Df Sum of Sq    RSS     AIC
## - Time      1    0.0708 3.6790 -151.95
## - Region    1    0.0902 3.6983 -151.65
## <none>                  3.6082 -151.08
## - Homes     1    2.3394 5.9475 -124.09
## - Sequence  1    4.6141 8.2223 -105.31
##
## Step:  AIC=-151.95
## Power ~ Homes + Region + Sequence
##
##            Df Sum of Sq     RSS      AIC
## - Region    1    0.0847  3.7637 -152.632
## <none>                   3.6790 -151.953
## - Homes     1    4.3768  8.0558 -108.495
## - Sequence  1    8.9427 12.6217  -82.451
##
## Step:  AIC=-152.63
## Power ~ Homes + Sequence
##
##            Df Sum of Sq     RSS      AIC
## <none>                   3.7637 -152.632
## - Homes     1    4.3297  8.0934 -110.225
## - Sequence  1    9.0959 12.8596  -83.368
```

```
##
## Call:
## lm(formula = Power ~ Homes + Sequence, data = dataset1)
##
## Coefficients:
## (Intercept)        Homes     Sequence
##     -2.6955       1.8676       0.5864
```

```
modelfoward =  stepAIC(power_lm_model,direction="backward",trace = FALSE)
step(modelfoward)
```

```
## Start:  AIC=-152.63
## Power ~ Homes + Sequence
##
##            Df Sum of Sq     RSS      AIC
## <none>                   3.7637 -152.632
## - Homes     1    4.3297  8.0934 -110.225
## - Sequence  1    9.0959 12.8596  -83.368
```

```
##
## Call:
## lm(formula = Power ~ Homes + Sequence, data = dataset1)
##
## Coefficients:
## (Intercept)        Homes     Sequence
##     -2.6955       1.8676       0.5864
```

```
modelfoward =  stepAIC(power_lm_model,direction="both",trace = FALSE)
step(modelfoward)
```

```
## Start:  AIC=-152.63
## Power ~ Homes + Sequence
##
##            Df Sum of Sq     RSS      AIC
## <none>                   3.7637 -152.632
## - Homes     1    4.3297  8.0934 -110.225
## - Sequence  1    9.0959 12.8596  -83.368
```

```
##
## Call:
## lm(formula = Power ~ Homes + Sequence, data = dataset1)
##
## Coefficients:
## (Intercept)        Homes     Sequence
##     -2.6955       1.8676       0.5864
```