MTH-522_InClass

Banoth Jeevan Kumar

- The below are the pictures of In class activity that I performed in My laptop

```
R version 4.3.2 (2023-10-31) -- "Eye Holes"
Copyright (C) 2023 The R Foundation for Statistical Computing
Platform: aarch64-apple-darwin20 (64-bit)

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  Natural language support but running in an English locale

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Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

[Workspace loaded from ~/.RData]

> tmp <- read.csv("/Users/jeevankumarbanoth/Downloads/auto-mpg.csv", header=TRUE)
> x <- matrix(0, nrow(tmp), (p-1))
> for(i in 1:(p-1)) {
+           x[, i] <- tmp[, (i+1)]
+       }
> y <- tmp[,1]
> n <- nrow(tmp)
> p <- 8
> x <- matrix(0, nrow = n, ncol = p - 1)
> for(i in 1:(p - 1)) {
+           x[, i] <- tmp[, (i + 1)]
+       }
> mylm <- lm(tmp[, 1] ~ ., data = tmp[, -1])
> summary(mylm)

Call:
lm(formula = tmp[, 1] ~ ., data = tmp[, -1])

Residuals:
    Min      1Q  Median      3Q     Max
-4.283  0.000  0.000  0.000  4.283

Coefficients: (43 not defined because of singularities)
                                        Estimate Std. Error t value
(Intercept)                           24.322728  17.973000   1.353
cylinders                             -1.856873   1.087221  -1.708
displacement                          -0.019630   0.028203  -0.696
```
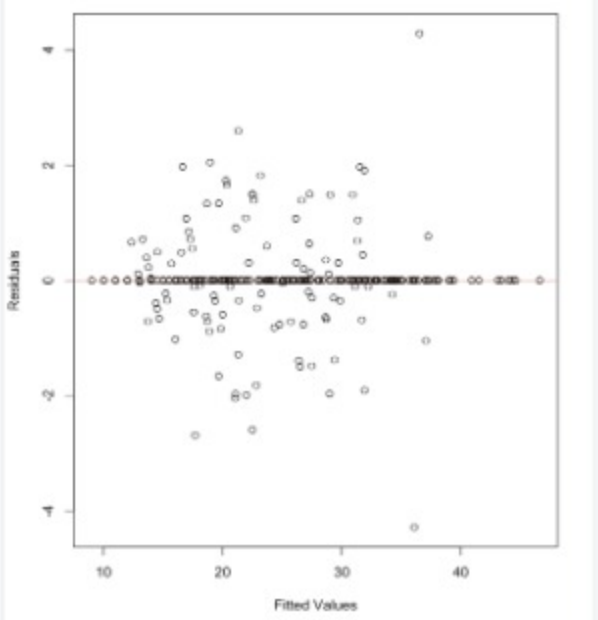
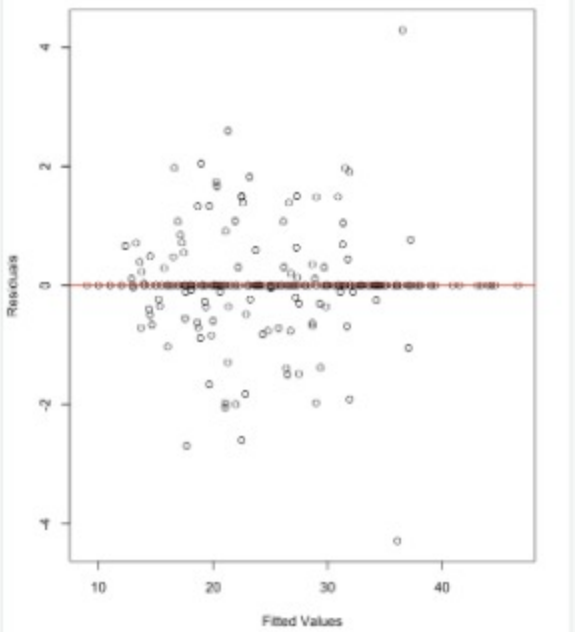
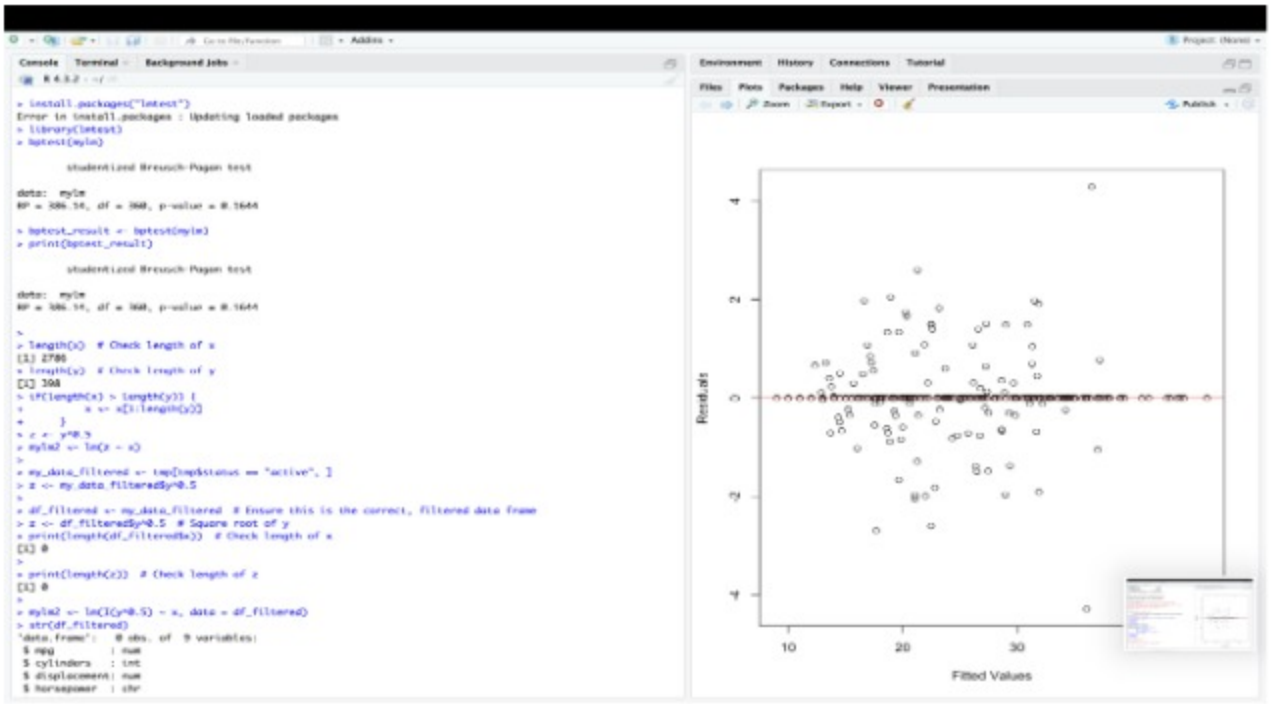
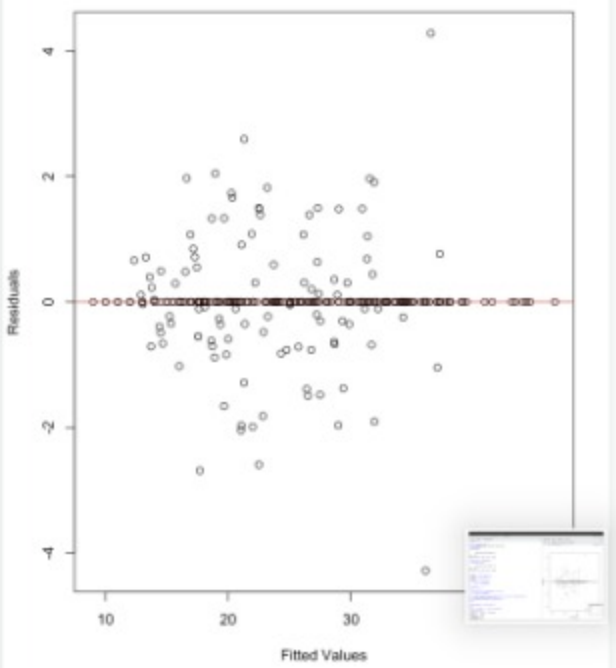




```
car.namedodge aspen                   0.76932
car.namedodge aspen 6                 0.96732
car.namedodge aspen se                0.84991
 [ reached getOption("max.print") -- omitted 204 rows ]
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.873 on 37 degrees of freedom
Multiple R-squared:  0.9934,    Adjusted R-squared:  0.9796
F-statistic: 15.57 on 360 and 37 DF,  p-value: 6.884e-16

> install.packages("car")
Installing package into '/Users/jeevankumarbanoth/Library/R/arm64/4.3/library'
(as 'lib' is unspecified)
trying URL 'https://cran.rstudio.com/bin/macosx/big-sur-arm64/contrib/4.3/car_3.1-2.tgz'
Content type 'application/x-gzip' length 1710465 bytes (1.6 MB)
==================================================
downloaded 1.6 MB


The downloaded binary packages are in
        /var/folders/64/hzfllkgx5h15j_zjl8nwbssn0000gn/T//RtmpTqI9tF/downloaded_packages
> library(car)
Loading required package: carData
> plot(fitted(mylm), resid(mylm), xlab = "Fitted Values", ylab = "Residuals")
> abline(h = 0, col = "red")
> library(MASS)
> boxcox(mylm)
> ncvTest(mylm)
Non-constant Variance Score Test
Variance formula: ~ fitted.values
Chisquare = 25.8174, Df = 1, p = 3.7529e-07
> plot(fitted(mylm), resid(mylm),
+           xlab = "Fitted values",
+           ylab = "Residuals",
+           main = "Residuals vs Fitted Values")
> abline(h = 0, col = "red")
> library(MASS)
> boxcox(mylm)
> library(lmtest)
Loading required package: zoo

Attaching package: 'zoo'

The following objects are masked from 'package:base':

    as.Date, as.Date.numeric
```

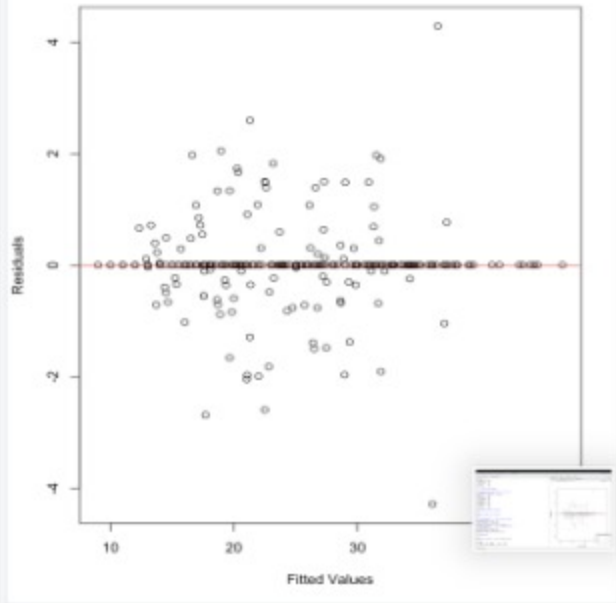


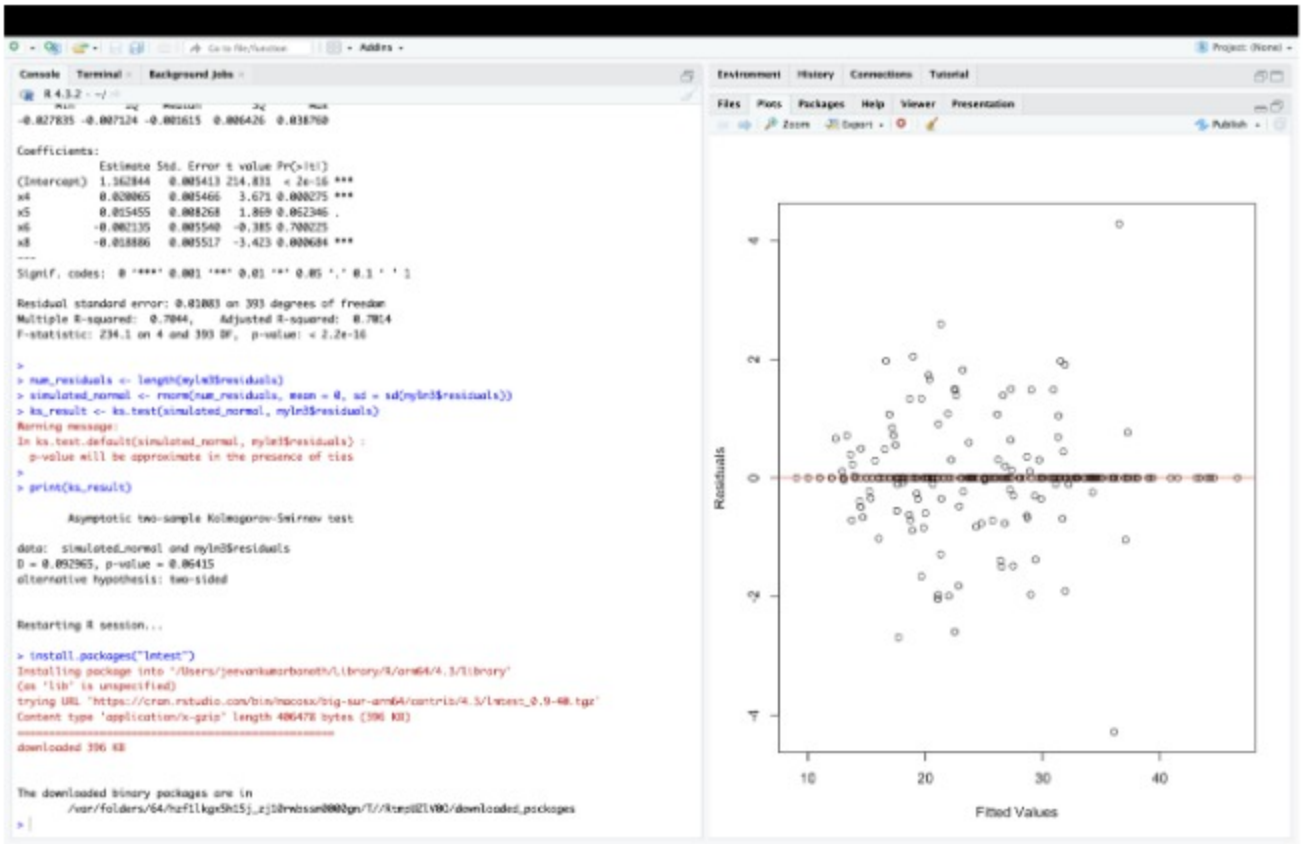

> install.packages("lmtest")
Error in install.packages : Updating loaded packages
> library(lmtest)
> bptest(mylm)
studentized Breusch-Pagan test
data: mylm
BP = 886.54, df = 368, p-value = 0.1644
> bptest_result <- bptest(mylm)
> print(bptest_result)
studentized Breusch-Pagan test
data: mylm
BP = 886.54, df = 368, p-value = 0.1644
> length(x) # Check length of x
[1] 2780
> length(y) # Check length of y
[1] 398
> if(length(x) > length(y)) {
+ x <- x[1:length(y)]
+ }
> z <- y^0.5
> mylm2 <- lm(y ~ x)
> my_data_filtered <- tmp[tmp$status == "active",]
> z <- my_data_filtered$y^0.5
> df_filtered <- my_data_filtered # Ensure this is the correct, filtered data frame
> z <- df_filtered$y^0.5 # Square root of y
> print(length(df_filtered$x)) # Check length of x
[1] 0
> print(length(z)) # Check length of z
[1] 0
> mylm2 <- lm(I(y^0.5) ~ x, data = df_filtered)
> str(df_filtered)
'data.frame': 0 obs. of 9 variables:
$ mpg : num
$ cylinders : int
$ displacement: num
$ horsepower : chr
Environment
History
Connections
Tutorial
Files
Plots
Packages
Help
Viewer
Presentation
Resid.dt
Fitted Values
10
20
30

```
 $ weight      : int
 $ acceleration: num
 $ model.year  : int
 $ origin      : int
 $ car.name    : chr
>
> z <- my_data_filtered$y^0.5
>
> my_data_filtered <- tmp[tmp$status == "active", ]
> str(my_data_filtered)
'data.frame':   0 obs. of  9 variables:
 $ mpg         : num
 $ cylinders   : int
 $ displacement: num
 $ horsepower  : chr
 $ weight      : int
 $ acceleration: num
 $ model.year  : int
 $ origin      : int
 $ car.name    : chr
>
> print(length(my_data_filtered$x))
[1] 0
>
> print(length(my_data_filtered$y))
[1] 0
>
> mylm2 <- lm(I(y^0.5) ~ x, data = my_data_filtered)
> ncvTest(mylm2)
Non-constant Variance Score Test
Variance formula: ~ fitted.values
Chisquare = 20.59574, Df = 1, p = 5.6722e-06
> mylm3 <- lm(I(y^0.05) ~ x, data = my_data_filtered)
> ncvTest(mylm3)
Non-constant Variance Score Test
Variance formula: ~ fitted.values
Chisquare = 2.523721, Df = 1, p = 0.12741
>
> summary(mylm2)

Call:
lm(formula = I(y^0.5) ~ x, data = my_data_filtered)

Residuals:
     Min       1Q   Median       3Q      Max
-1.14403 -0.28765 -0.09418  0.27018  1.71134

Coefficients:
```




```
> summary(mylm2)

Call:
lm(formula = I(y^0.5) ~ x, data = my_data_filtered)

Residuals:
     Min       1Q   Median       3Q      Max
-1.14403 -0.28765 -0.09418  0.27018  1.71134

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  4.52665    0.22916  19.753  < 2e-16 ***
x4           0.86082    0.23140   3.717 0.000231 ***
x5           0.66622    0.35005   1.903 0.057742 .
x6          -0.07358    0.23456  -0.314 0.753925
x8          -0.67457    0.23357  -2.888 0.004090 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.4583 on 393 degrees of freedom
Multiple R-squared:  0.6776,    Adjusted R-squared:  0.6743
F-statistic: 206.5 on 4 and 393 DF,  p-value: < 2.2e-16

> summary(mylm3)

Call:
lm(formula = I(y^0.05) ~ x, data = my_data_filtered)

Residuals:
      Min       1Q   Median       3Q      Max
-0.027835 -0.007124 -0.001615  0.006426  0.038760

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.162844   0.005413 214.831  < 2e-16 ***
x4           0.020065   0.005466   3.671 0.000275 ***
x5           0.015455   0.008268   1.869 0.062346 .
x6          -0.002135   0.005540  -0.385 0.700225
x8          -0.018886   0.005517  -3.423 0.000684 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01083 on 393 degrees of freedom
Multiple R-squared:  0.7044,    Adjusted R-squared:  0.7014
F-statistic: 234.1 on 4 and 393 DF,  p-value: < 2.2e-16

>
> num_residuals <- length(mylm3$residuals)
```





- **The below one is the markdown file of my work.**

MTH-522_InClass

Jeevan

2024-03-24

```
tmp <- read.csv("/Users/jeevankumarbanoth/Downloads/auto-mpg.csv",
header=TRUE)
```

```
x <- matrix(0, nrow(tmp), (p-1))
for(i in 1:(p-1)) {
     x[, i] <- tmp[, (i+1)]
 }
y <- tmp[,1]
n <- nrow(tmp)
p <- 8
```

```
x <- matrix(0, nrow = n, ncol = p - 1)
for(i in 1:(p - 1)) {
     x[, i] <- tmp[, (i + 1)]
 }
```

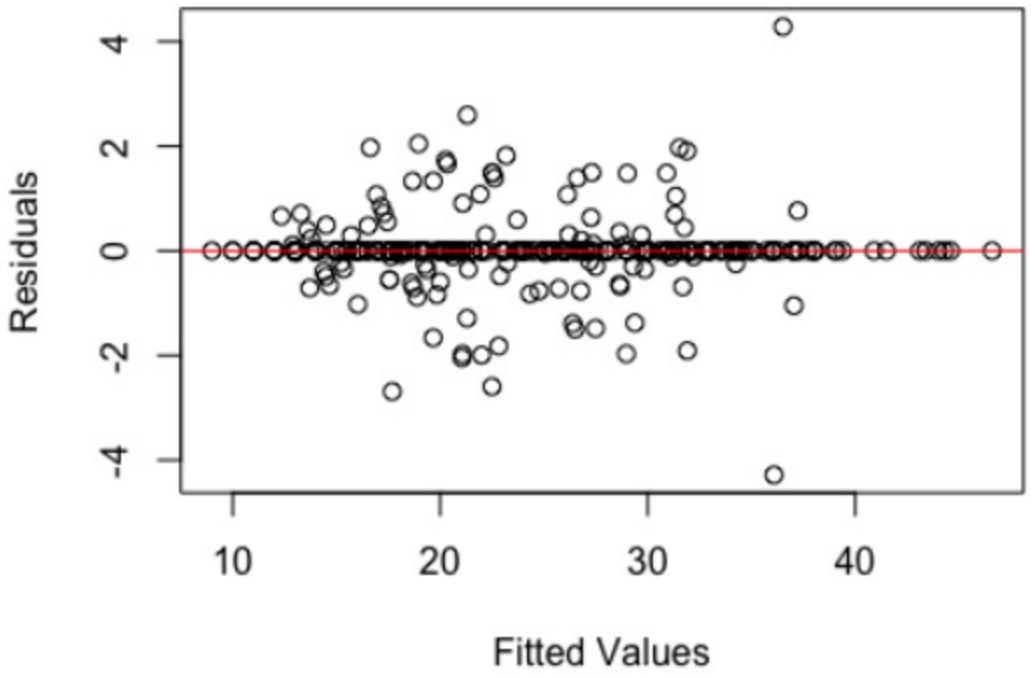
```
mylm <- lm(tmp[, 1] ~ ., data = tmp[, -1])
summary(mylm)
```

```
##
## Call:
## lm(formula = tmp[, 1] ~ ., data = tmp[, -1])
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -4.283  0.000  0.000  0.000  4.283
##
## Coefficients: (43 not defined because of singularities)
##                                              Estimate Std. Error t value
## (Intercept)                                 24.322728  17.973000   1.353
## cylinders                                   -1.856873   1.087221  -1.708
## displacement                                -0.019630   0.028203  -0.696
## horsepower100                               -3.976684   3.190125  -1.247
## car.namevw rabbit custom                         NA
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2.073 on 37 degrees of freedom
## Multiple R-squared:  0.9934, Adjusted R-squared:  0.9296
## F-statistic: 15.57 on 360 and 37 DF,  p-value: 6.084e-16
```

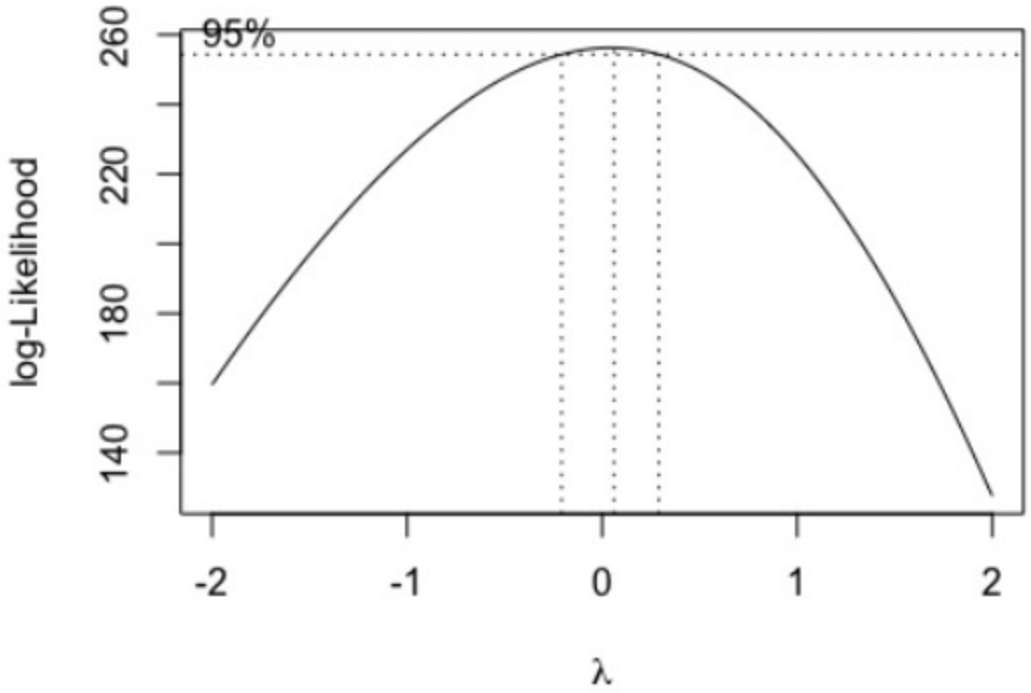
```
install.packages("car")
library(car)
```

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

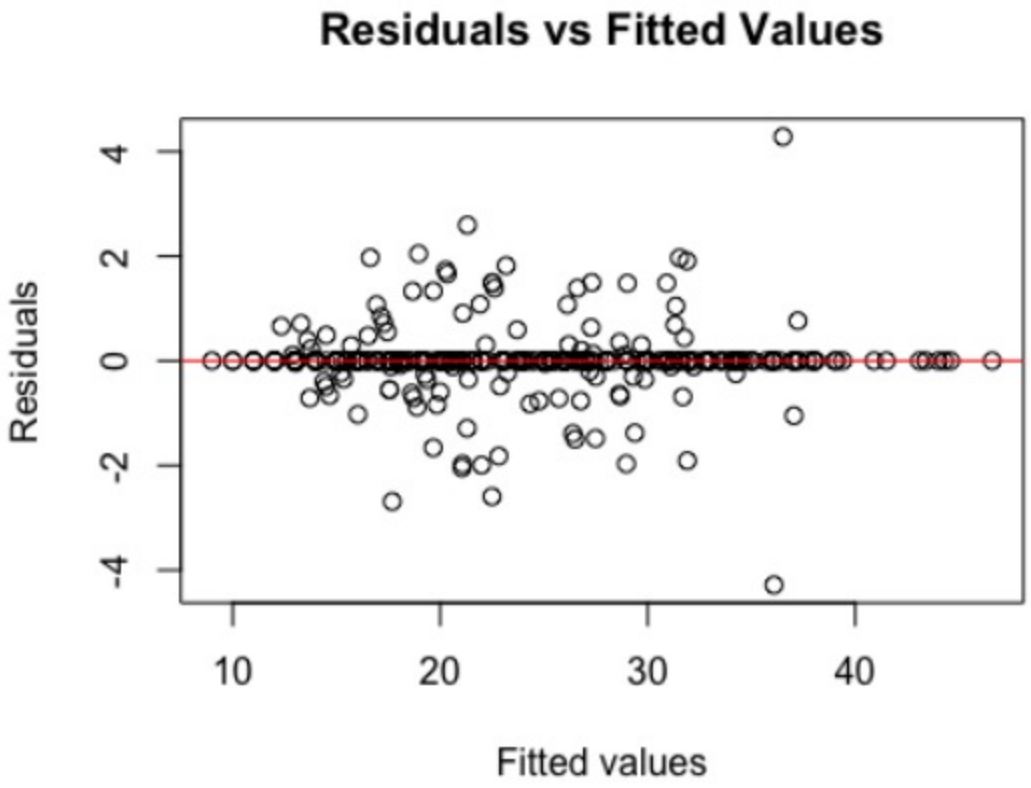
```
plot(fitted(mylm), resid(mylm), xlab = "Fitted Values", ylab = "Residuals")
abline(h = 0, col = "red")
```



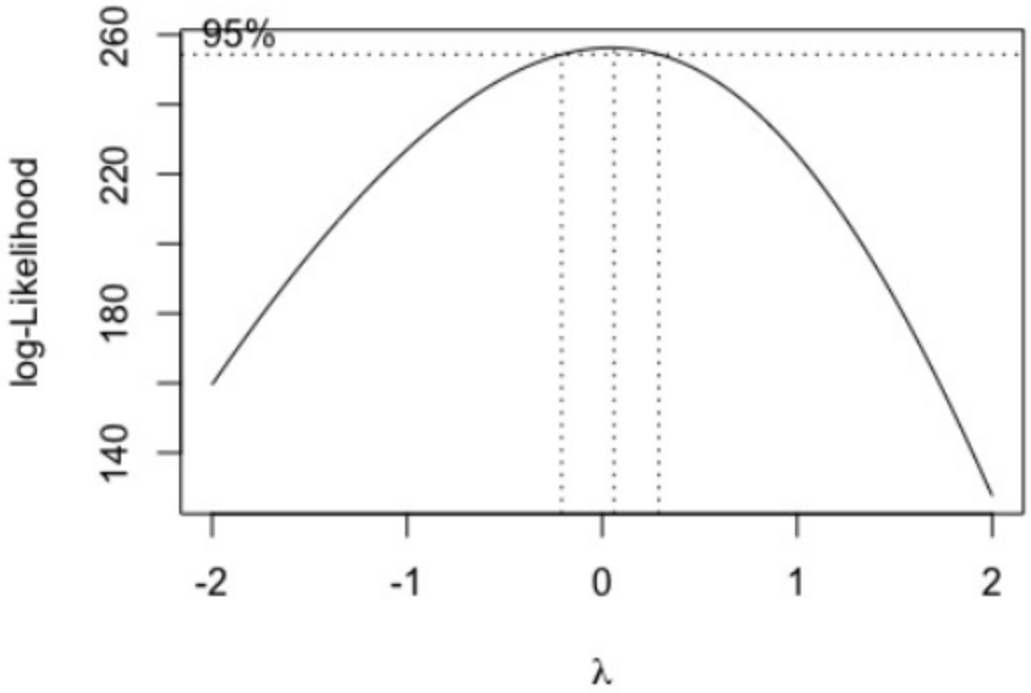

```
library(MASS)
boxcox(mylm)
```




```
ncvTest(mylm)

## Non-constant Variance Score Test
## Variance formula: ~ fitted.values
## Chisquare = 25.8174, Df = 1, p = 3.7529e-07

plot(fitted(mylm), resid(mylm),
      xlab = "Fitted values",
      ylab = "Residuals",
      main = "Residuals vs Fitted Values")
abline(h = 0, col = "red")
```




```
library(MASS)
boxcox(mylm)
```




```
library(lmtest)
```

```
## Loading required package: zoo
```

```
##
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```
bptest(mylm)
```

```
##
##  studentized Breusch-Pagan test
##
## data:  mylm
## BP = 386.14, df = 360, p-value = 0.1644
```

```
bptest_result <- bptest(mylm)
print(bptest_result)
```

```
##
##  studentized Breusch-Pagan test
##
```

```
## data:  mylm
## BP = 386.14, df = 360, p-value = 0.1644
```

```
length(x)  # Check length of x
length(y)  # Check length of y
if(length(x) > length(y)) {
+    x <- x[1:length(y)]
+ }
z <- y^0.5
mylm2 <- lm(z ~ x)
```

```
my_data_filtered <- tmp[tmp$status == "active", ]
z <- my_data_filtered$y^0.5

df_filtered <- my_data_filtered

z <- df_filtered$y^0.5  # Square root of y
print(length(df_filtered$x))  # Check length of x

## [1] 0

print(length(z))  # Check length of z

## [1] 0

str(df_filtered)

## 'data.frame':    0 obs. of  9 variables:
##  $ mpg         : num
##  $ cylinders   : int
##  $ displacement: num
##  $ horsepower  : chr
##  $ weight      : int
##  $ acceleration: num
##  $ model.year  : int
##  $ origin      : int
##  $ car.name    : chr

z <- my_data_filtered$y^0.5

my_data_filtered <- tmp[tmp$status == "active", ]
str(my_data_filtered)

## 'data.frame':    0 obs. of  9 variables:
##  $ mpg         : num
##  $ cylinders   : int
##  $ displacement: num
##  $ horsepower  : chr
##  $ weight      : int
##  $ acceleration: num
##  $ model.year  : int
##  $ origin      : int
##  $ car.name    : chr
```

```r
print(length(my_data_filtered$x))
```

```
## [1] 0
```

```r
print(length(my_data_filtered$y))
```

```
## [1] 0
```

```r
mylm2 <- lm(I(y^0.5) ~ x, data = df_filtered)
str(df_filtered)

z <- my_data_filtered$y^0.5

my_data_filtered <- tmp[tmp$status == "active", ]
str(my_data_filtered)

print(length(my_data_filtered$x))

print(length(my_data_filtered$y))

mylm2 <- lm(I(y^0.5) ~ x, data = my_data_filtered)
ncvTest(mylm2)
```

```
## Non-constant Variance Score Test
## Variance formula: ~ fitted.values
## Chisquare = 25.8174, Df = 1, p = 3.7529e-07
```

```r
mylm3 <- lm(I(y^0.05) ~ x, data = my_data_filtered)
ncvTest(mylm3)
```

```
## Non-constant Variance Score Test
## Variance formula: ~ fitted.values
## Chisquare = 25.8174, Df = 1, p = 3.7529e-07
```

```r
summary(mylm2)
```

```
Call:
lm(formula = I(y^0.5) ~ x, data = my_data_filtered)

Residuals:
   Min     1Q  Median     3Q    Max
-1.14403 -0.28765 -0.09418  0.27018  1.71134

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  4.52665    0.22916  19.753  < 2e-16 ***
x4           0.86002    0.23140   3.717 0.000231 ***
x5           0.66622    0.35005   1.903 0.057742 .
x6          -0.07358    0.23456  -0.314 0.753925
x8          -0.67457    0.23357  -2.888 0.004090 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.4583 on 393 degrees of freedom
```

```
Multiple R-squared:  0.6776,    Adjusted R-squared:  0.6743
F-statistic: 206.5 on 4 and 393 DF,  p-value: < 2.2e-16
```

```
summary(mylm)
```

```
Call:
lm(formula = I(y^0.05) ~ x, data = my_data_filtered)

Residuals:
     Min       1Q   Median       3Q      Max
-0.027835 -0.007124 -0.001615  0.006426  0.038760

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.162844   0.005413 214.831  < 2e-16 ***
x4           0.020065   0.005466   3.671 0.000275 ***
x5           0.015455   0.008268   1.869 0.062346 .
x6          -0.002135   0.005540  -0.385 0.700225
x8          -0.018886   0.005517  -3.423 0.000684 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.01083 on 393 degrees of freedom
Multiple R-squared:  0.7044,    Adjusted R-squared:  0.7014
F-statistic: 234.1 on 4 and 393 DF,  p-value: < 2.2e-16
```

```
num_residuals <- length(mylm$residuals)
simulated_normal <- rnorm(num_residuals, mean = 0, sd = sd(mylm$residuals))
ks_result <- ks.test(simulated_normal, mylm$residuals)

## Warning in ks.test.default(simulated_normal, mylm$residuals): p-value will
be
## approximate in the presence of ties

print(ks_result)

##
##  Asymptotic two-sample Kolmogorov-Smirnov test
##
## data:  simulated_normal and mylm$residuals
## D = 0.40201, p-value < 2.2e-16
## alternative hypothesis: two-sided
```