Untitled

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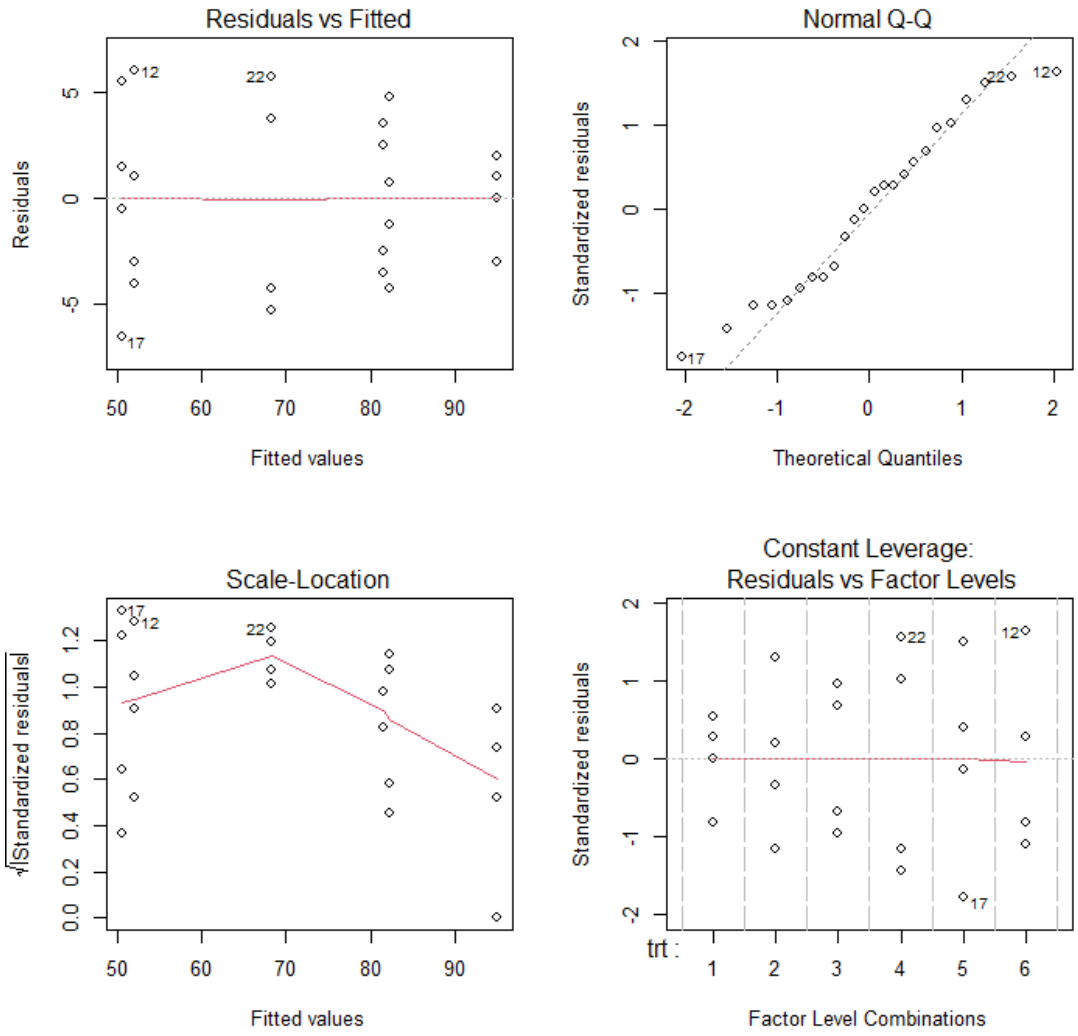
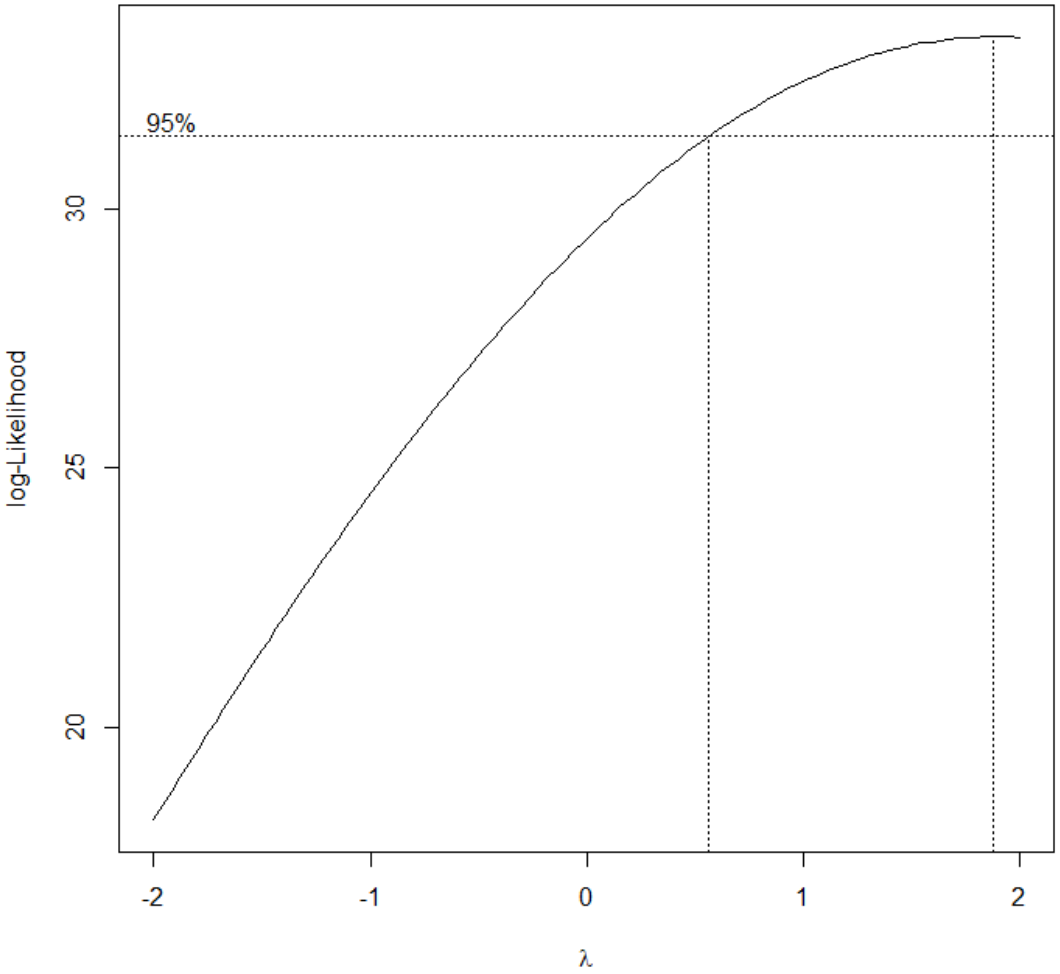
```
data=read.table("http://www.stat.umn.edu/~gary/book/fcdae.data/pr6.1",header=
TRUE)
attach(data)
trt=as.factor(trt)
m=lm(y~trt)
par(mfrow=c(2,2))
plot(m)
```

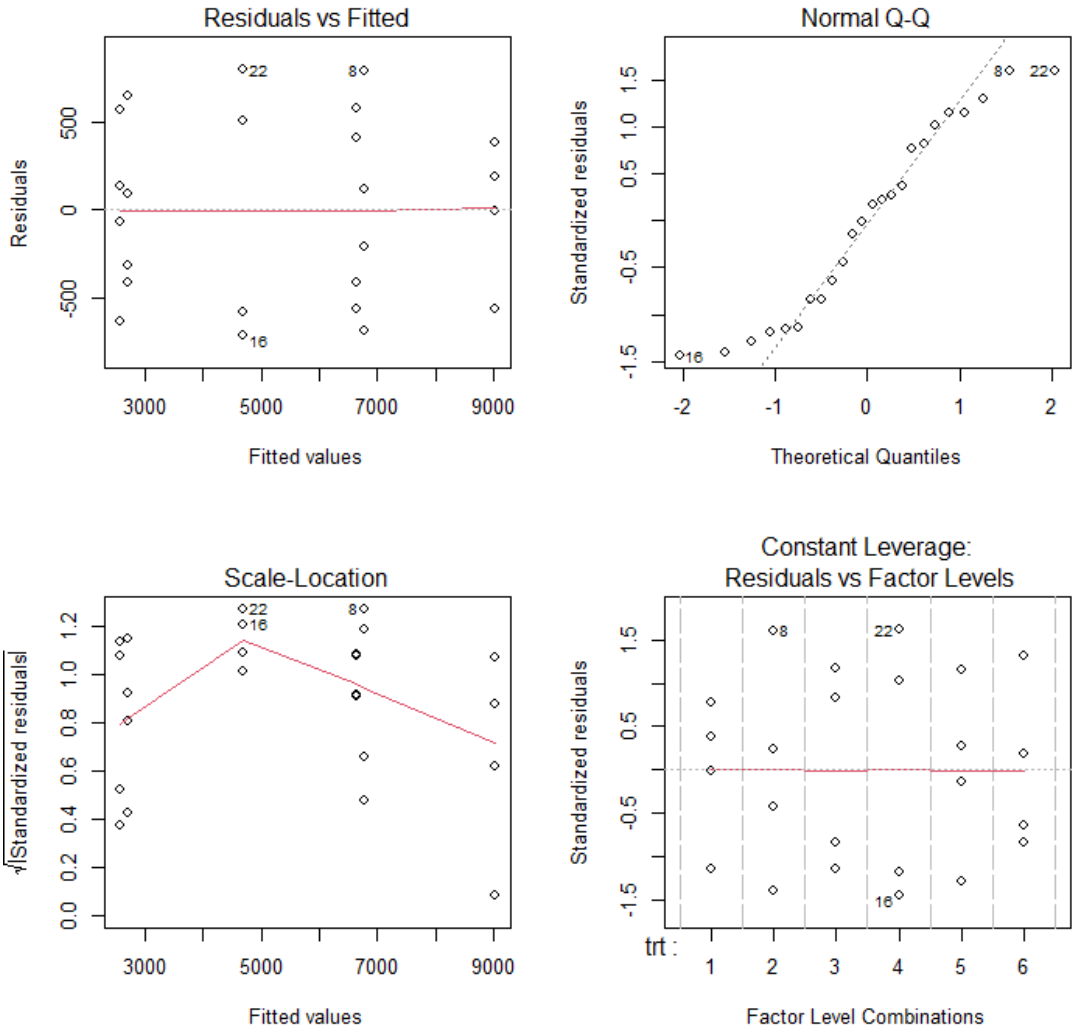


```
#The data need transformation because we see that from the residual vs fitted plot it has a megaphone effect, hence the assumption of equal error variance failed, though the error follow normality as the normal Q-Q plot shows most points on the straight line.

library(MASS)
bc=boxcox(m)
```




```
i=which.max(bc$y)
bc$x[i]

## [1] 1.878788

#The power transformation suggested by box-cox transformation is 1.878788, hence for professionalism we choose power of 2

y2=y^2
m2=lm(y2~trt)
```

```
par(mfrow=c(2,2))
summary(m2)

##
## Call:
## lm(formula = y2 ~ trt)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -712.2 -452.8   43.0  429.1  794.8
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)   9028.5      284.4  31.741  < 2e-16 ***
## trt2         -2252.8      402.3  -5.600 2.58e-05 ***
## trt3         -2377.0      402.3  -5.909 1.36e-05 ***
## trt4         -4347.3      402.3 -10.807 2.67e-09 ***
## trt5         -6459.5      402.3 -16.058 4.10e-12 ***
## trt6         -6309.0      402.3 -15.684 6.10e-12 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 568.9 on 18 degrees of freedom
## Multiple R-squared:  0.9569, Adjusted R-squared:  0.9449
## F-statistic: 79.95 on 5 and 18 DF,  p-value: 1.19e-11

plot(m2)
```




```
#The megaphone effect get lessened so we will use the transform data for our
analysis.

anova(m2)

## Analysis of Variance Table
##
## Response: y2
##           Df    Sum Sq  Mean Sq F value   Pr(>F)
## trt        5 129364348 25872870  79.947 1.19e-11 ***
## Residuals 18   5825245   323625
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

#The small p-value from ANOVA F-Score reject the null hypothesis that all
treatment mean are equal.
m2=aov(y2 ~ trt)
```

```r
cis=TukeyHSD(m2, which="trt", ordered=T, conf.level=0.95)
cis
```

```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##     factor levels have been ordered
##
## Fit: aov(formula = y2 ~ trt)
##
## $trt
##        diff        lwr      upr     p adj
## 6-5  150.50 -1127.8933 1428.893 0.9988700
## 4-5 2112.25   833.8567 3390.643 0.0006582
## 3-5 4082.50  2804.1067 5360.893 0.0000001
## 2-5 4206.75  2928.3567 5485.143 0.0000001
## 1-5 6459.50  5181.1067 7737.893 0.0000000
## 4-6 1961.75   683.3567 3240.143 0.0014425
## 3-6 3932.00  2653.6067 5210.393 0.0000002
## 2-6 4056.25  2777.8567 5334.643 0.0000001
## 1-6 6309.00  5030.6067 7587.393 0.0000000
## 3-4 1970.25   691.8567 3248.643 0.0013797
## 2-4 2094.50   816.1067 3372.893 0.0007216
## 1-4 4347.25  3068.8567 5625.643 0.0000000
## 2-3  124.25 -1154.1433 1402.643 0.9995529
## 1-3 2377.00  1098.6067 3655.393 0.0001702
## 1-2 2252.75   974.3567 3531.143 0.0003194
```