bayblade.pdf

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Client (Arjun Raman) submitted experiment with 4 replicates upon 8 expermental units. The data document time in motion of an experimental unit:BayBlade. Client wishes to know if the Bayblades are significantly different, and the fastest/slowest bayblades. The dataframe is shown below.

```
bayblade<-read.csv("~/Desktop/514/bayblade.csv", sep=",", header=T)
bayblade
```

```
##   pg  p gr yo  y  o gg  b
## 1 84 35 23 46 32 71 66 40
## 2 75 36 17 43 35 72 54 37
## 3 71 38 18 47 26 65 49 36
## 4 87 33 25 47 33 76 51 42
```

```
m<-as.matrix(bayblade)
sapply( 1:8, function(x) { mean(m[,x]) })
```

```
## [1] 79.25 35.50 20.75 45.75 31.50 71.00 55.00 38.75
```

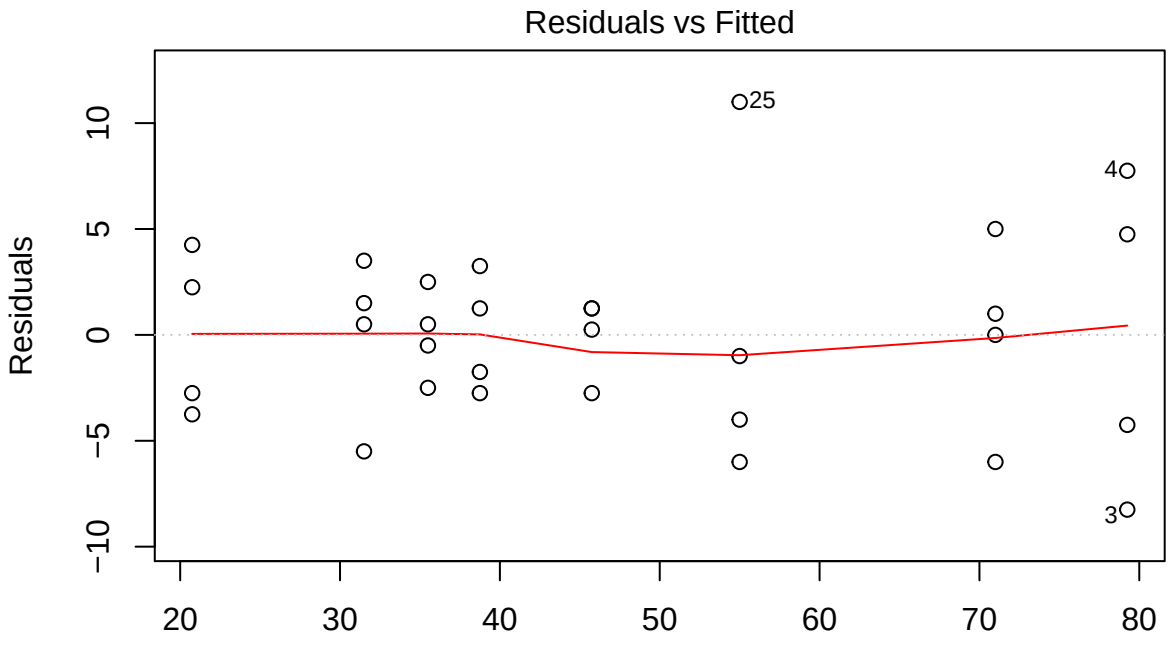
Lets fit a linear model with 8 factors & perform Analysis of Variance.

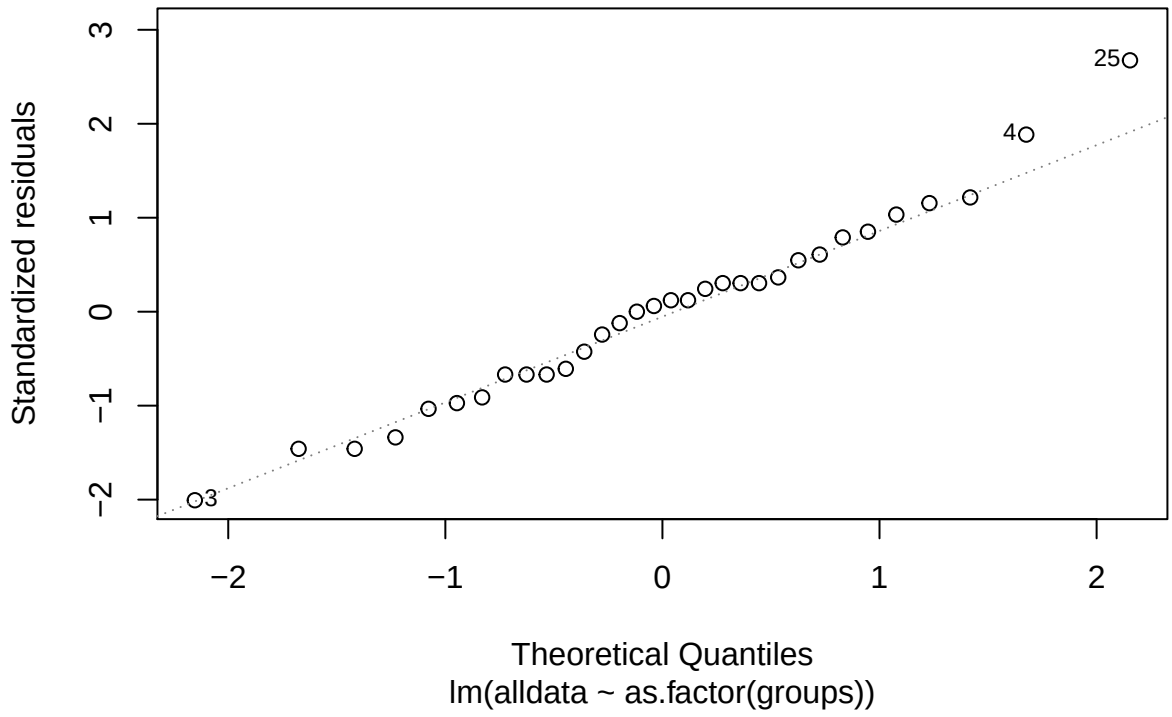
```
alldata<- c(m[,1],m[,2],m[,3],m[,4],m[,5],m[,6],m[,7],m[,8])
groups<- c(rep(1,4),rep(2,4),rep(3,4),rep(4,4),rep(5,4),rep(6,4),rep(7,4),rep(8,4))
model<-lm(alldata~as.factor(groups))
summary(model)
```

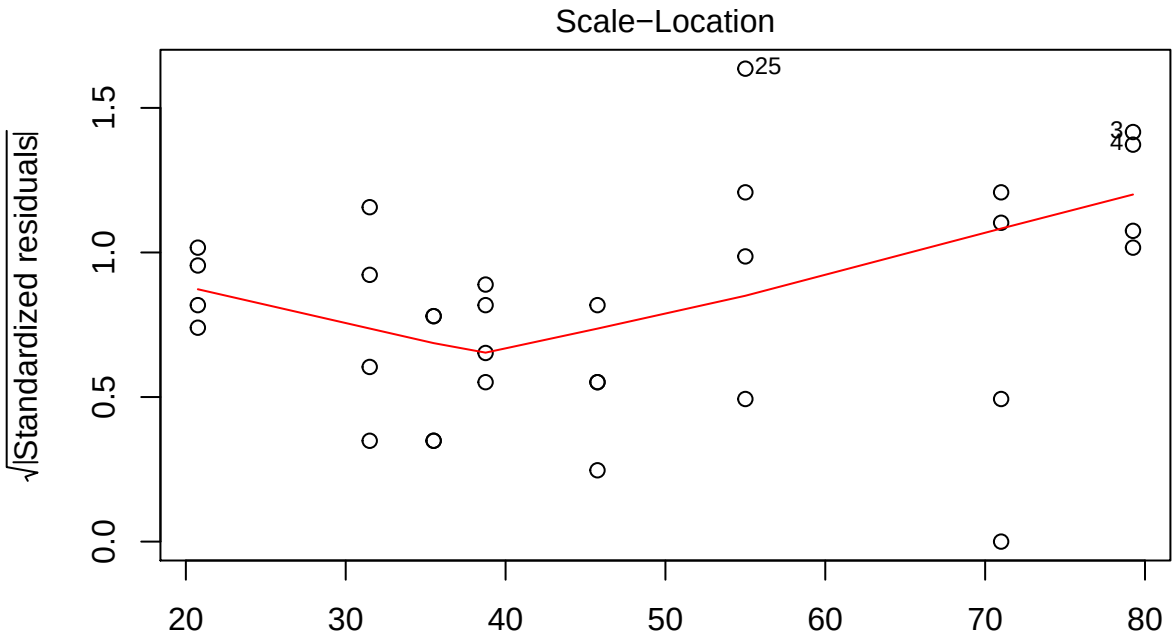
```
##
## Call:
## lm(formula = alldata ~ as.factor(groups))
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -8.250 -2.750  0.375  2.312 11.000
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)           79.250      2.374  33.384  < 2e-16 ***
## as.factor(groups)2  -43.750      3.357 -13.032 2.22e-12 ***
## as.factor(groups)3  -58.500      3.357 -17.425 3.98e-15 ***
## as.factor(groups)4  -33.500      3.357  -9.979 5.13e-10 ***
## as.factor(groups)5  -47.750      3.357 -14.223 3.44e-13 ***
## as.factor(groups)6   -8.250      3.357  -2.457   0.0216 *
## as.factor(groups)7  -24.250      3.357  -7.223 1.83e-07 ***
## as.factor(groups)8  -40.500      3.357 -12.064 1.12e-11 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

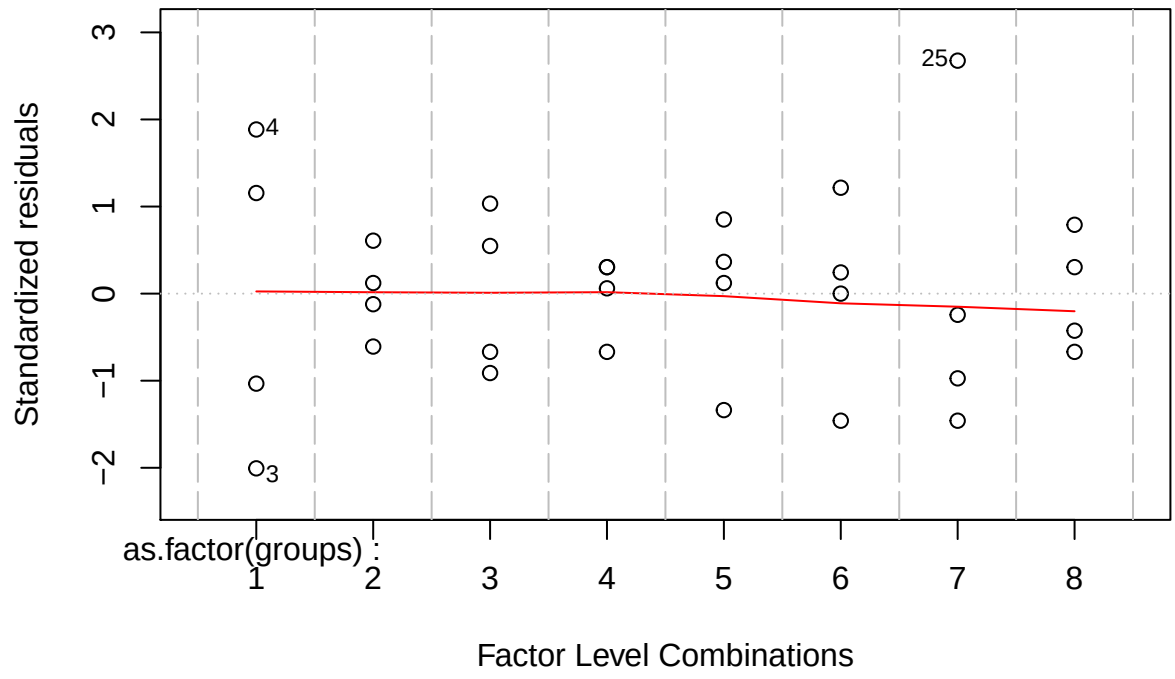
```
##
## Residual standard error: 4.748 on 24 degrees of freedom
## Multiple R-squared:  0.9541, Adjusted R-squared:  0.9407
## F-statistic: 71.26 on 7 and 24 DF,  p-value: 1.653e-14
```

```
plot(model)
```









An analysis of variance is given below:

```
anova(model)
```

```
## Analysis of Variance Table
##
## Response: alldata
```

```
##                   Df Sum Sq Mean Sq F value    Pr(>F)
## as.factor(groups)  7  11244 1606.27  71.258 1.653e-14 ***
## Residuals         24    541   22.54
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Conclusion: The p-value 1.6e-14 is highly significant, indicating at a 5% level, the bayblades are significantly different from each other. The F test has a score of 71 $>>$ 1, confirming the difference of the means. The fastest bayblade is group1 (pg) with mean time: 79.25 The slowest bayblade is group3 (gr) with mean time: 79.25 - 58.5 = 20.75

The Order statistics are: gr $<$ y $<$ p $<$ b $<$ yo $<$ gg $<$ o $<$ pg