# anova_splittimes.R

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```
#Read Marathon data dile
#fname = file.choose()
fname = "/Users/poojasingh/Documents/HStatE139/git/statse139-project2/statse139-project/Previous Boston
dfm = read.csv(fname, header=T,sep=" ")
names(dfm)
```

```
##  [1] "BibNum"     "Year"       "Age"        "Gender1F2M" "StartHr"
##  [6] "StartMin"   "K0.5"       "K5.10"      "K10.15"     "K15.20"
## [11] "K20.25"     "K25.30"     "K30.35"     "K35.40"     "K40.Fin"
## [16] "HalfMar"    "X"          "Age2014"
```

```
n= length(dfm)
n
```

```
## [1] 18
```

```
#Add all times
times = as.matrix(dfm[,7:15], ncol=9)
times.20.40 = times = as.matrix(dfm[,11:15], ncol=9)
dfm$totaltime = rowSums(times)
dfm$cummtime.20.40 = rowSums(times)
attach(dfm)

#Split data by year
dfm.2010 = subset(dfm, (dfm$Year==2010))
length(dfm.2010$Year) ## of rows for 2010
```

```
## [1] 22670
```

```
#Fit AOV model - varitions between two split times
model2 = aov(dfm.2010$K0.5~dfm.2010$K5.10)
model2
```

```
## Call:
##    aov(formula = dfm.2010$K0.5 ~ dfm.2010$K5.10)
##
## Terms:
##                 dfm.2010$K5.10 Residuals
## Sum of Squares       252466.92  15100.48
## Deg. of Freedom              1     22668
##
## Residual standard error: 0.8161854
## Estimated effects may be unbalanced
```

```r
#plot(model2)

#Define matrix with column1 representing different groups of split times and column 2 representing dist
m = matrix(nrow = 5, ncol = 2)
c1 = c("K0.5", "K5.10", "K10.15", "K15.20", "K20.25", "K25.30", "K30.35", "K35.40", "K40.Fin")
c2 = c(dfm.2010$K0.5, dfm.2010$K5.10, dfm.2010$K10.15, dfm.2010$K15.20, dfm.2010$K20.25, dfm.2010$K25.3
m=cbind(c1,c2)
head(m)
```

```
##      c1       c2
## [1,] "K0.5"   "25.4"
## [2,] "K5.10"  "26.32"
## [3,] "K10.15" "28.93"
## [4,] "K15.20" "26.72"
## [5,] "K20.25" "25.2"
## [6,] "K25.30" "25.92"
```

```r
#Fit AOV model - variation across all split times
model1 = aov(m[,2]~m[,1])
model1
```

```
## Call:
##    aov(formula = m[, 2] ~ m[, 1])
##
## Terms:
##                   m[, 1] Residuals
## Sum of Squares         5   8928288
## Deg. of Freedom        8    204021
##
## Residual standard error: 6.615256
## Estimated effects may be unbalanced
```

```r
#plot(model1)

#Fit ANOVA model - using the recommendation in the article
#TotalTime ~ mean of response + half.mar.time + scaled-time(20-40/half.mar.time)

#Calculate mean of the totaltime
dfm.2010.totaltime.mean = mean(dfm.2010$totaltime)
dfm.2010.totaltime.mean
```

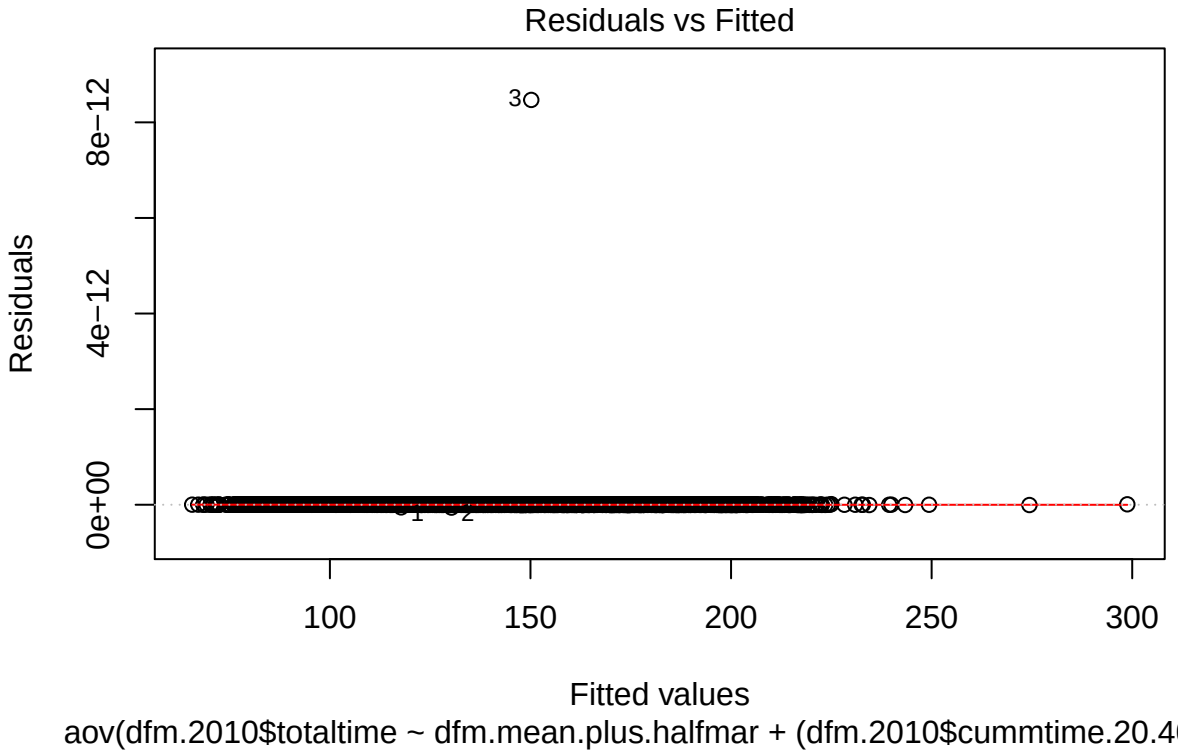
```
## [1] 126.8356
```

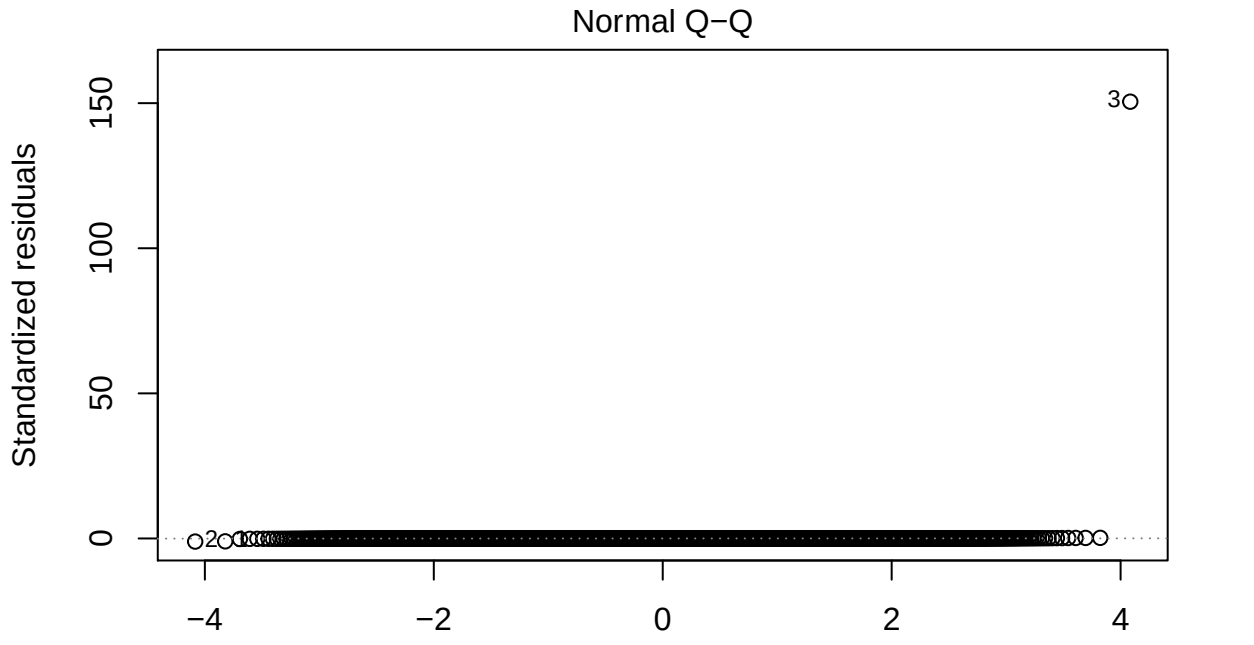
```r
#Add the mean to half marathon
dfm.mean.plus.halfmar = dfm.2010.totaltime.mean  + dfm.2010$HalfMar

#AOV model
modelr = aov(dfm.2010$totaltime ~ dfm.mean.plus.halfmar  + (dfm.2010$cummtime.20.40/dfm.2010$HalfMar))
modelr
```

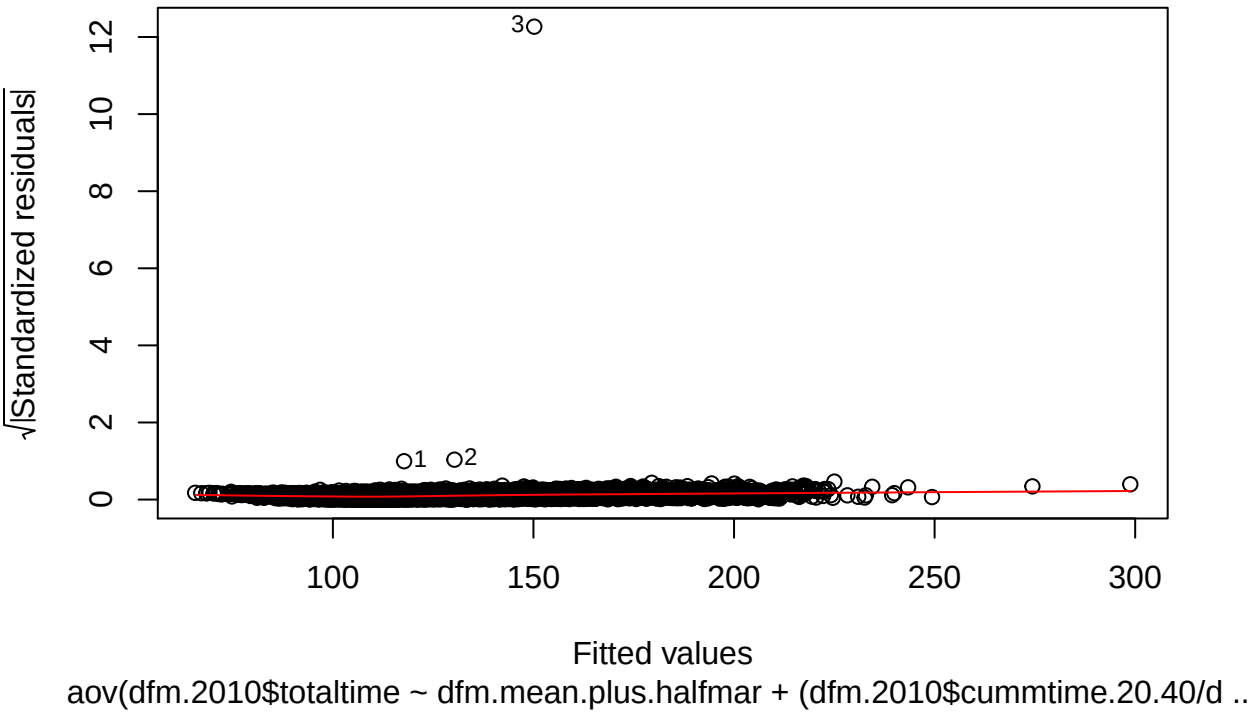
```
## Call:
```

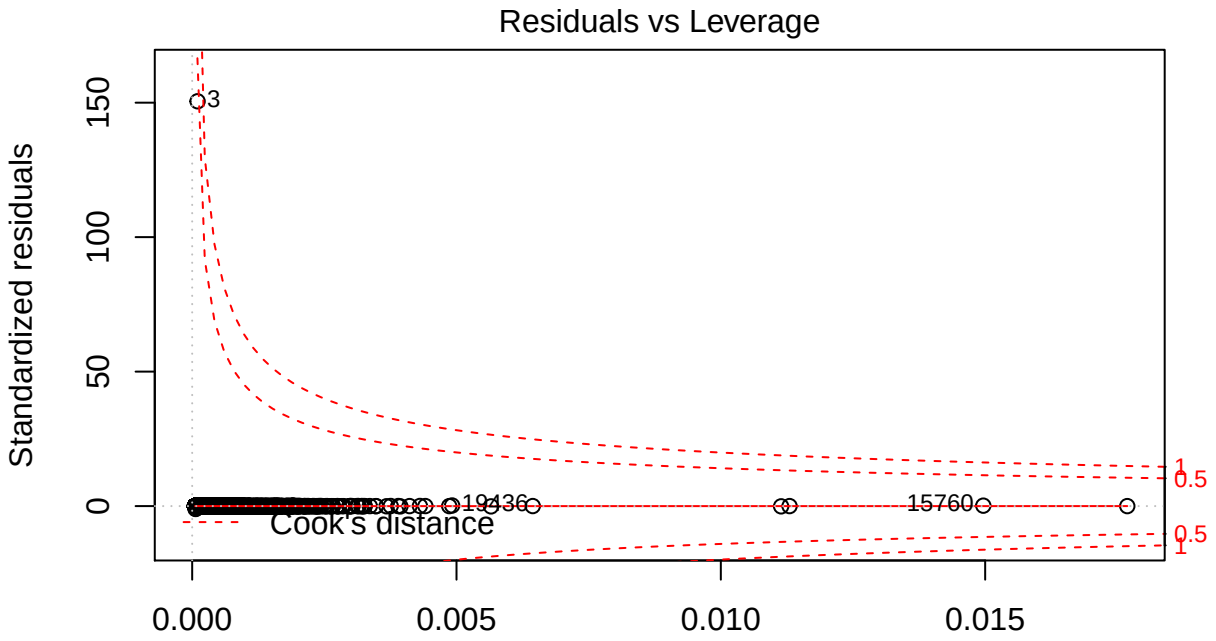
```
##    aov(formula = dfm.2010$totaltime ~ dfm.mean.plus.halfmar + (dfm.2010$cummtime.20.40/dfm.2010$Halfl
##
## Terms:
##                 dfm.mean.plus.halfmar dfm.2010$cummtime.20.40
## Sum of Squares                9606472                 2868009
## Deg. of Freedom                     1                       1
##                 dfm.2010$cummtime.20.40:dfm.2010$HalfMar Residuals
## Sum of Squares                                         0         0
## Deg. of Freedom                                        1     22659
##
## Residual standard error: 5.62714e-14
## Estimated effects may be unbalanced
## 7 observations deleted due to missingness
```

```
plot(modelr)
```




Normal Q−Q
Standardized residuals
Theoretical Quantiles
aov(dfm.2010$totaltime ~ dfm.mean.plus.halfmar + (dfm.2010$cummtime.20.40/d ..


Scale−Location
√|Standardized residuals|
Fitted values
aov(dfm.2010$totaltime ~ dfm.mean.plus.halfmar + (dfm.2010$cummtime.20.40/d ..




aov(dfm.2010$totaltime ~ dfm.mean.plus.halfmar + (dfm.2010$cummtime.20.40/d ..