Pedestrian Light ANOVA Example - Practice Problem #9

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```
#get means for each group
sapply(split(pedestrian.light$TIME,as.factor(pedestrian.light$PUSHES)),mean)
```

```
##        0        1        2        3
## 38.20714 38.17100 38.19400 38.21200
```

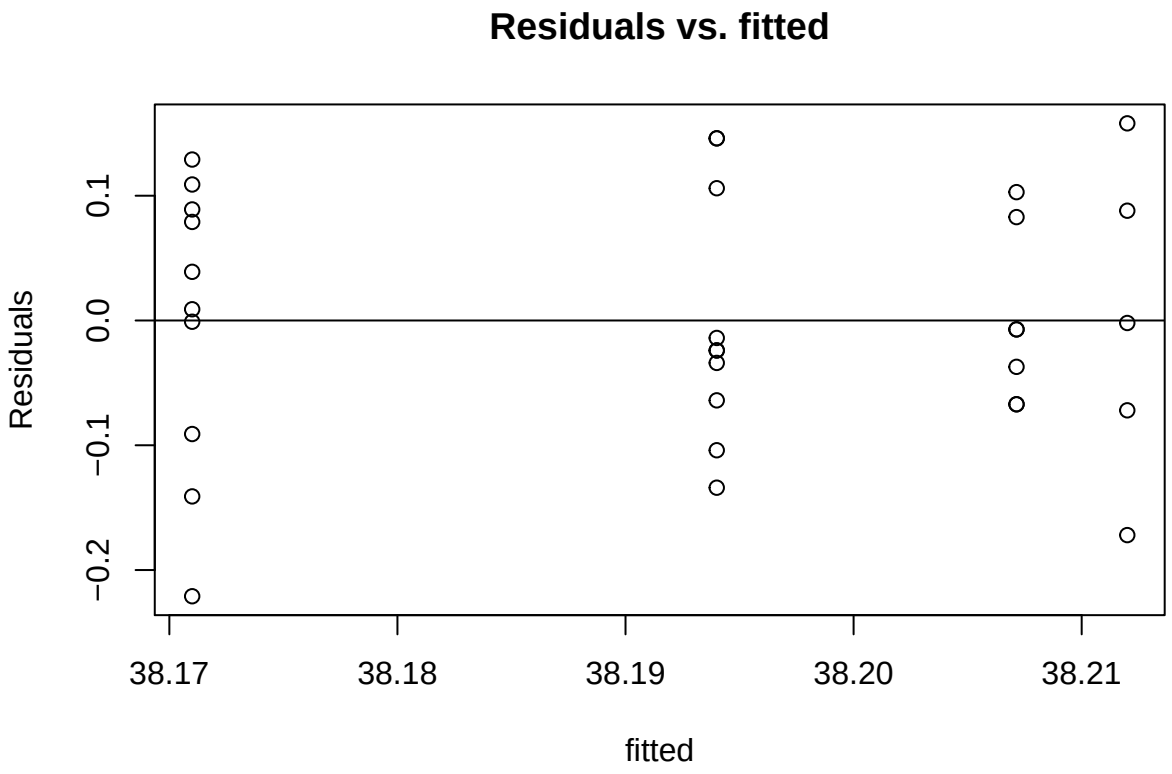
```
#ls
ped.aov <- lm(TIME~as.factor(PUSHES),data=pedestrian.light)
summary(ped.aov)
```

```
##
## Call:
## lm(formula = TIME ~ as.factor(PUSHES), data = pedestrian.light)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.221000 -0.067143 -0.007143  0.088250  0.158000
##
## Coefficients:
##                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)         38.207143   0.039509 967.042   <2e-16 ***
## as.factor(PUSHES)1 -0.036143   0.051514  -0.702    0.489
## as.factor(PUSHES)2 -0.013143   0.051514  -0.255    0.800
## as.factor(PUSHES)3  0.004857   0.061208   0.079    0.937
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1045 on 28 degrees of freedom
## Multiple R-squared:  0.02563,    Adjusted R-squared:  -0.07877
## F-statistic: 0.2455 on 3 and 28 DF,  p-value: 0.8638
```

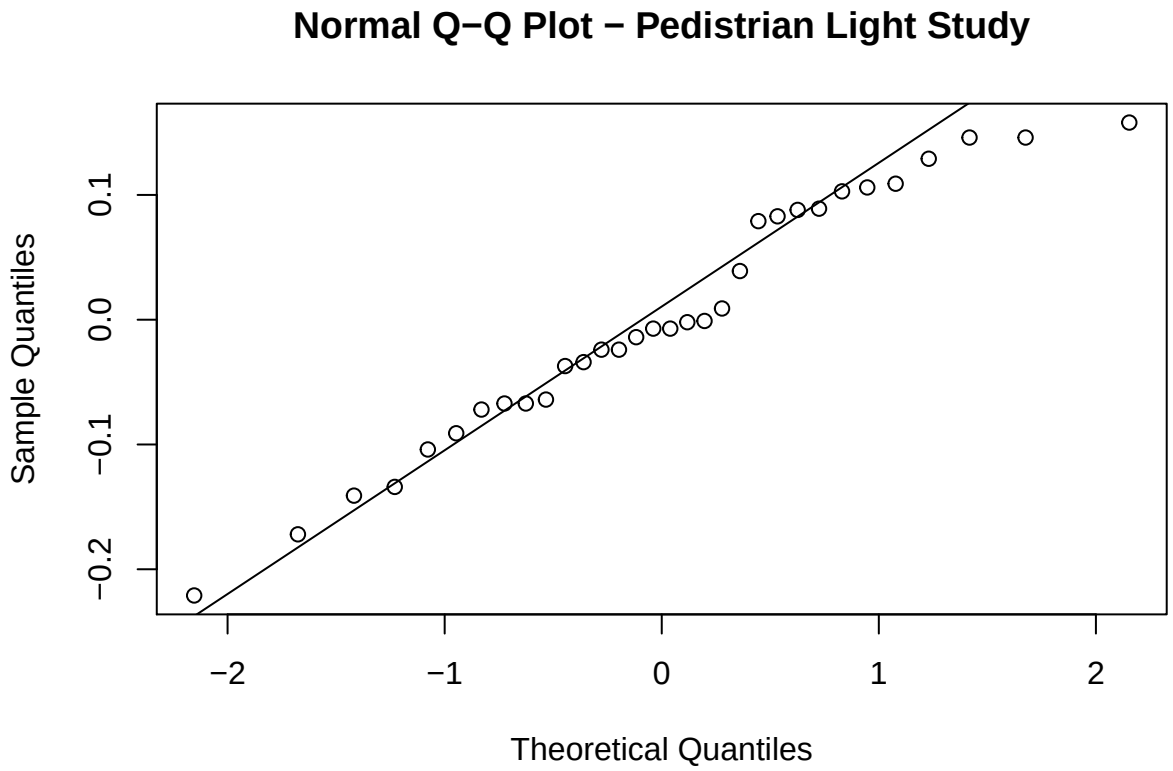
```
anova(ped.aov)
```

```
## Analysis of Variance Table
##
## Response: TIME
##                   Df   Sum Sq   Mean Sq F value Pr(>F)
## as.factor(PUSHES)  3 0.008047 0.0026824  0.2455 0.8638
## Residuals         28 0.305953 0.0109269
```

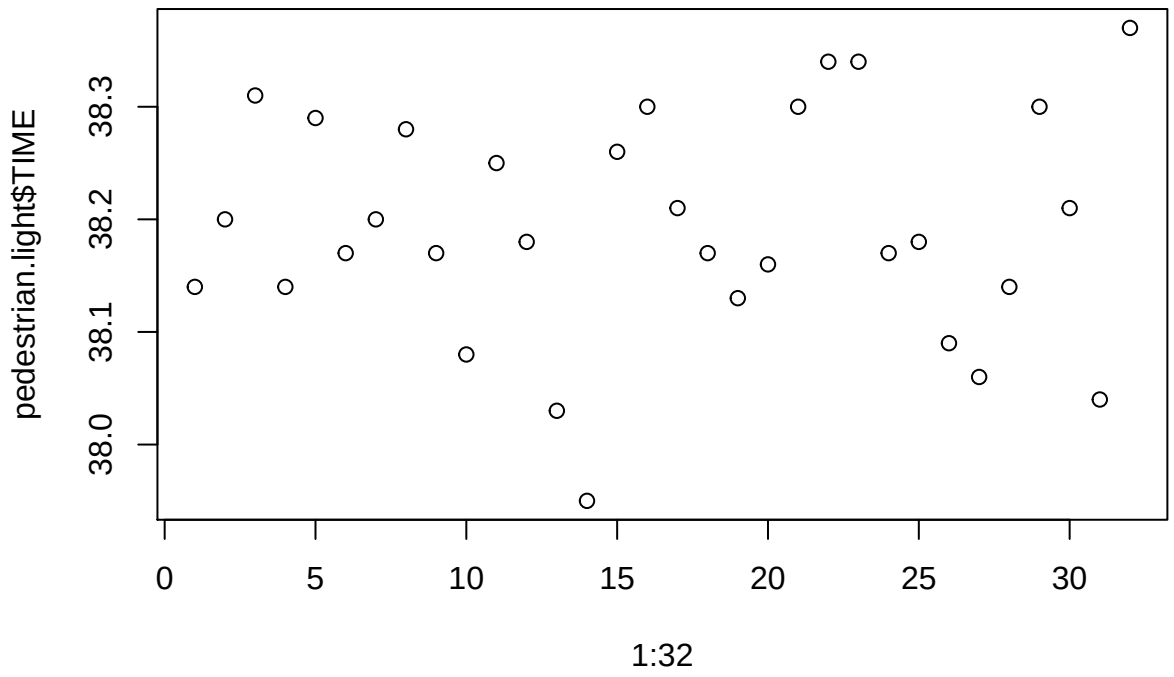
```
plot(ped.aov$fitted.values,ped.aov$residuals,main="Residuals vs. fitted",xlab="fitted",ylab="Residuals"
abline(h=0)
```




```
qqnorm(ped.aov$residuals,main="Normal Q-Q Plot - Pedistrian Light Study");qqline(ped.aov$residuals)
```



```r
plot(1:32,pedestrian.light$TIME)
```




```r
TukeyHSD(aov(TIME~as.factor(PUSHES),data=pedestrian.light))
```

```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = TIME ~ as.factor(PUSHES), data = pedestrian.light)
##
## $`as.factor(PUSHES)`
##             diff        lwr       upr     p adj
## 1-0 -0.036142857 -0.1767916 0.1045059 0.8955744
## 2-0 -0.013142857 -0.1537916 0.1275059 0.9940396
## 3-0  0.004857143 -0.1622585 0.1719728 0.9998162
## 2-1  0.023000000 -0.1046367 0.1506367 0.9602303
## 3-1  0.041000000 -0.1153224 0.1973224 0.8898585
## 3-2  0.018000000 -0.1383224 0.1743224 0.9890012
```

```r
aov1 <- aov(TIME~as.factor(PUSHES),data=pedestrian.light)
pairwise.t.test(pedestrian.light$TIME,as.factor(pedestrian.light$PUSHES),p.adj="bonf")
```

```
##
##  Pairwise comparisons using t tests with pooled SD
##
## data:  pedestrian.light$TIME and as.factor(pedestrian.light$PUSHES)
##
##   0 1 2
## 1 1 - -
## 2 1 1 -
```

```
## 3 1 1 1
##
## P value adjustment method: bonferroni
```

```
push <- as.factor(pedestrian.light$PUSHES)

#0 push vs. 1 push
t.test(pedestrian.light$TIME[push=="0"],pedestrian.light$TIME[push=="1"],var.equal=T)
```

```
##
##  Two Sample t-test
##
## data:  pedestrian.light$TIME[push == "0"] and pedestrian.light$TIME[push == "1"]
## t = 0.73529, df = 15, p-value = 0.4735
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.06862718  0.14091289
## sample estimates:
## mean of x mean of y
##  38.20714  38.17100
```

```
#0 push vs. 2 push
t.test(pedestrian.light$TIME[push=="0"],pedestrian.light$TIME[push=="2"],var.equal=T)
```

```
##
##  Two Sample t-test
##
## data:  pedestrian.light$TIME[push == "0"] and pedestrian.light$TIME[push == "2"]
## t = 0.30174, df = 15, p-value = 0.767
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.07969752  0.10598324
## sample estimates:
## mean of x mean of y
##  38.20714  38.19400
```

```
#0 push vs. 3 push
t.test(pedestrian.light$TIME[push=="0"],pedestrian.light$TIME[push=="3"],var.equal=T)
```

```
##
##  Two Sample t-test
##
## data:  pedestrian.light$TIME[push == "0"] and pedestrian.light$TIME[push == "3"]
## t = -0.084918, df = 10, p-value = 0.934
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.1323028  0.1225885
## sample estimates:
## mean of x mean of y
##  38.20714  38.21200
```

```r
#1 push vs. 2 push
t.test(pedestrian.light$TIME[push=="1"],pedestrian.light$TIME[push=="2"],var.equal=T)
```

```
##
##  Two Sample t-test
##
## data:  pedestrian.light$TIME[push == "1"] and pedestrian.light$TIME[push == "2"]
## t = -0.47555, df = 18, p-value = 0.6401
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.12461216  0.07861216
## sample estimates:
## mean of x mean of y
##    38.171    38.194
```

```r
#1 push vs. 3 push
t.test(pedestrian.light$TIME[push=="1"],pedestrian.light$TIME[push=="3"],var.equal=T)
```

```
##
##  Two Sample t-test
##
## data:  pedestrian.light$TIME[push == "1"] and pedestrian.light$TIME[push == "3"]
## t = -0.6212, df = 13, p-value = 0.5452
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.1835881  0.1015881
## sample estimates:
## mean of x mean of y
##    38.171    38.212
```

```r
#2 push vs. 3 push
t.test(pedestrian.light$TIME[push=="2"],pedestrian.light$TIME[push=="3"],var.equal=T)
```

```
##
##  Two Sample t-test
##
## data:  pedestrian.light$TIME[push == "2"] and pedestrian.light$TIME[push == "3"]
## t = -0.29931, df = 13, p-value = 0.7694
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##  -0.1479209  0.1119209
## sample estimates:
## mean of x mean of y
##    38.194    38.212
```