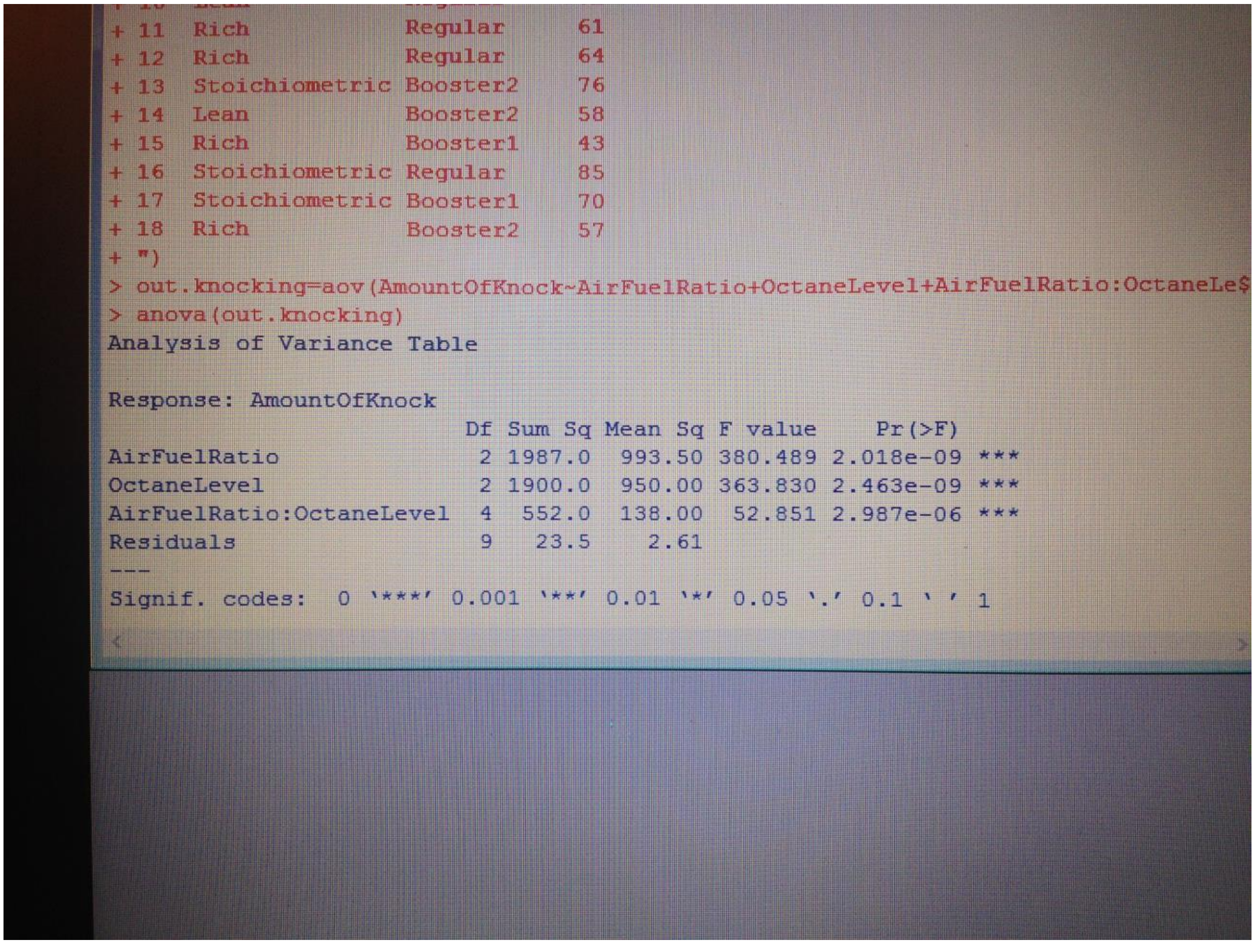
Here's what I put together for the R code with the data given by Christian.
-Jason

```
#STAT 201
#Group Final Project
#Christian Price, Joseph Lyon, Jason Biesinger, Jesse Van Horn, Jon Wilson, Rex Henretta
#Fall 2015

#Data
knocking=read.table(header=TRUE,text="
Run AirFuelRatio   OctaneLevel AmountOfKnock
1   Lean          Booster1       30
2   Rich          Booster2       58
3   Stoichiometric Regular       82
4   Lean          Regular        75
5   Stoichiometric Booster1      70
6   Lean          Booster1       30
7   Lean          Booster2       55
8   Stoichiometric Booster2      75
9   Rich          Booster1       46
10  Lean          Regular        72
11  Rich          Regular        61
12  Rich          Regular        64
13  Stoichiometric Booster2      76
14  Lean          Booster2       58
15  Rich          Booster1       43
16  Stoichiometric Regular       85
17  Stoichiometric Booster1      70
18  Rich          Booster2       57
")


#fit the model
out.knocking=aov(AmountOfKnock~AirFuelRatio+OctaneLevel+AirFuelRatio:OctaneLevel,data=
knocking)

#Inference
anova(out.knocking)

#95% Conf Interval
TukeyHSD(out.knocking)

#Mean by factor
by(knocking$AmountOfKnock,knocking$AirFuelRatio,mean)
```

```
by(knocking$AmountOfKnock,knocking$OctaneLevel,mean)

#Standard Deviation by factor
by(knocking$AmountOfKnock,knocking$AirFuelRatio,sd)
by(knocking$AmountOfKnock,knocking$OctaneLevel,sd)

#Best plot for Air/Fuel Ratio
main.effect<-c(53.33333,54.83333,76.33333)  # from
by(knocking$AmountOfKnock,knocking$AirFuelRatio,mean)
se<-sqrt( 993.50 / 2)   # Mean Sq Residuals / number of replicates
mp<-barplot(main.effect,names=c("Lean","Rich","Stoichiometric"),
        col=c("blue","green","black"),
        ylab="Amount of Knock",xlab="Air / Fuel Ratio",
        ylim=c(0,100))
arrows(mp,main.effect-se,mp,main.effect+se,
        code=3,angle=90,col="gray")


#Best plot for Octane Level
main.effect<-c(73.16667,48.16667,63.16667)   #from
by(knocking$AmountOfKnock,knocking$OctaneLevel,mean)
se<-sqrt( 950.00 / 2)   # Mean Sq Residuals / number of replicates
mp<-barplot(main.effect,names=c("Regular","Booster #1","Booster #2"),
        col=c("red","brown","yellow"),
        ylab="Amount of Knocking",xlab="Octane Level",
        ylim=c(0,100))
arrows(mp,main.effect-se,mp,main.effect+se,
        code=3,angle=90,col="gray")

#QQ plot
qqnorm(resid(out.knocking))
resid(out.knocking)

#Interaction
interaction.plot(knocking$AirFuelRatio,knocking$OctaneLevel,knocking$AmountOfKnock,type='
b')
```



```
+ 11  Rich          Regular     61
+ 12  Rich          Regular     64
+ 13  Stoichiometric Booster2   76
+ 14  Lean          Booster2    58
+ 15  Rich          Booster1    43
+ 16  Stoichiometric Regular    85
+ 17  Stoichiometric Booster1   70
+ 18  Rich          Booster2    57
+ ")
> out.knocking=aov(AmountOfKnock~AirFuelRatio+OctaneLevel+AirFuelRatio:OctaneLe$
> anova(out.knocking)
Analysis of Variance Table

Response: AmountOfKnock
                         Df Sum Sq Mean Sq F value    Pr(>F)
AirFuelRatio              2 1987.0  993.50 380.489 2.018e-09 ***
OctaneLevel               2 1900.0  950.00 363.830 2.463e-09 ***
AirFuelRatio:OctaneLevel  4  552.0  138.00  52.851 2.987e-06 ***
Residuals                 9   23.5    2.61
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

the p-values are all less than 0.05

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se<-sqrt( 950.00 / 2)   # Mean Sq Residuals / number of replicates
mp<-barplot(main.effect,names=c("Regular","Booster #1","Booster #2"),
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