M9 Problem Set ANOVA for TAs

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#1. Import libraries and load packages

```
library(tidyverse)
library(dplyr)
library(readxl)
```

#2. Importing our data

```
crop.data <- read.csv(file = "crop.data.csv", header = TRUE)
```

#.Normality

```
#normality
by(crop.data$yield, crop.data$fertilizer, shapiro.test)
```

```
## crop.data$fertilizer: Nitrogen
##
##  Shapiro-Wilk normality test
##
## data:  dd[x, ]
## W = 0.97914, p-value = 0.7743
##
## ------------------------------------------------------------
## crop.data$fertilizer: Phosphorus
##
##  Shapiro-Wilk normality test
##
## data:  dd[x, ]
## W = 0.98329, p-value = 0.8875
##
## ------------------------------------------------------------
## crop.data$fertilizer: Potasium
##
##  Shapiro-Wilk normality test
##
## data:  dd[x, ]
## W = 0.95878, p-value = 0.2542
```

#Variance

```r
#variance
bartlett.test(yield ~ fertilizer, data=crop.data)
```

```
##
##  Bartlett test of homogeneity of variances
##
## data:  yield by fertilizer
## Bartlett's K-squared = 1.0622, df = 2, p-value = 0.5879
```

#3. Run a Simple Linear Regresion

```r
one.way <- aov(yield ~ fertilizer, data = crop.data)
summary(one.way)
```

```
##             Df Sum Sq Mean Sq F value Pr(>F)
## fertilizer   2   6.07  3.0340   7.863  7e-04 ***
## Residuals   93  35.89  0.3859
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

#4. #Tukey, all pairs comparison

```r
TukeyHSD(one.way)
```

```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = yield ~ fertilizer, data = crop.data)
##
## $fertilizer
##                           diff         lwr       upr     p adj
## Phosphorus-Nitrogen 0.1761687 -0.19371896 0.5460564 0.4954705
## Potasium-Nitrogen   0.5991256  0.22923789 0.9690133 0.0006125
## Potasium-Phosphorus 0.4229568  0.05306916 0.7928445 0.0208735
```

```r
plot(TukeyHSD(one.way))
```


95% family−wise confidence level
Phosphorus−Nitrogen
Potasium−Phosphorus
−0.2
0.0
0.2
0.4
0.6
0.8
1.0
Differences in mean levels of fertilizer