Worksheet 4

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Load Libraries

```
library(tidyverse)
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.4     v readr     2.1.5
## v forcats   1.0.0     v stringr   1.5.1
## v ggplot2   3.5.1     v tibble    3.2.1
## v lubridate 1.9.4     v tidyr     1.3.1
## v purrr     1.0.2
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

```
library(readxl)
```

Interaction Plot

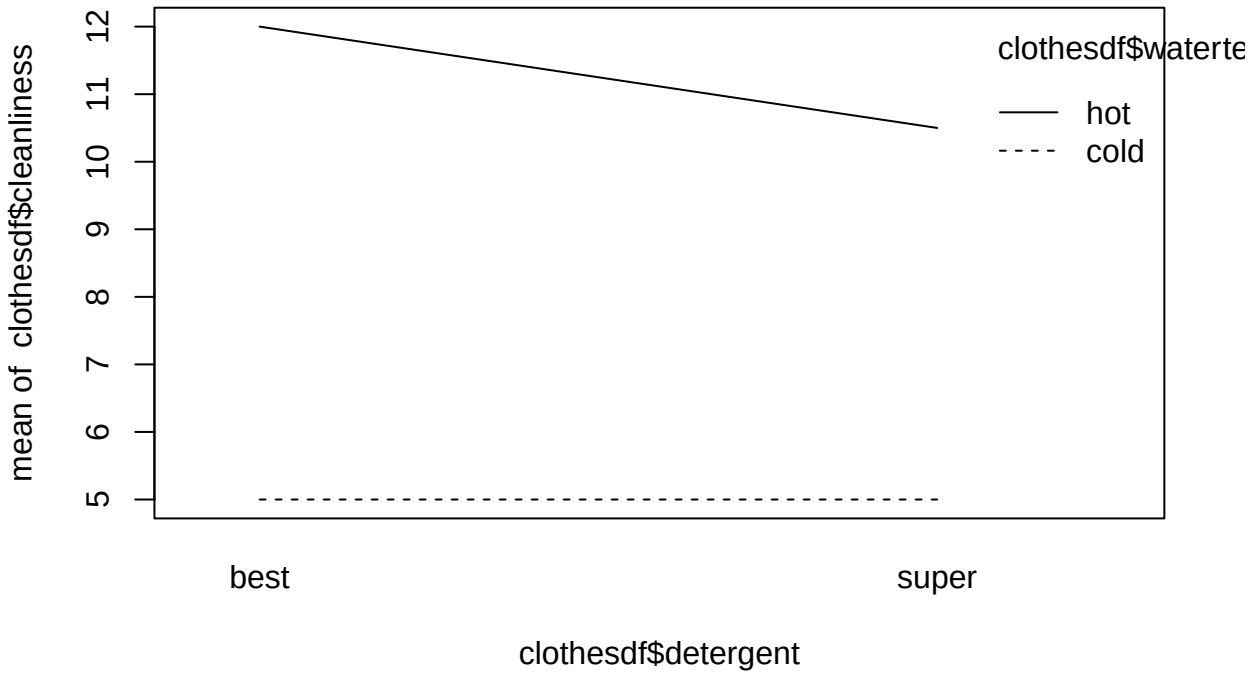
```
detergent <- rep(c("super", "best"), each = 8)
watertemp <- rep(c("cold", "hot"), each = 4)
cleanliness <- c(4, 5, 6, 5, 10, 12, 11, 9, 6, 6, 4, 4, 12, 13, 10, 13)
clothesdf <- data.frame(detergent, watertemp, cleanliness)
clothesdf # "Always double check your data entry" - Professor Wei
```

```
##    detergent watertemp cleanliness
## 1      super      cold           4
## 2      super      cold           5
## 3      super      cold           6
## 4      super      cold           5
## 5      super       hot          10
## 6      super       hot          12
## 7      super       hot          11
## 8      super       hot           9
## 9       best      cold           6
## 10      best      cold           6
## 11      best      cold           4
## 12      best      cold           4
## 13      best       hot          12
## 14      best       hot          13
## 15      best       hot          10
## 16      best       hot          13
```

```r
model1 <- aov(cleanliness~detergent+watertemp+detergent*watertemp, data = clothesdf)
summary(model1)
```

```
##                      Df Sum Sq Mean Sq F value  Pr(>F)
## detergent             1   2.25    2.25   1.588   0.232
## watertemp             1 156.25  156.25 110.294 2.1e-07 ***
## detergent:watertemp   1   2.25    2.25   1.588   0.232
## Residuals            12  17.00    1.42
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
interaction.plot(clothesdf$detergent, clothesdf$watertemp, clothesdf$cleanliness, fun = mean)
```



Note: 2.1e-07 = 2.1 x 10^-7

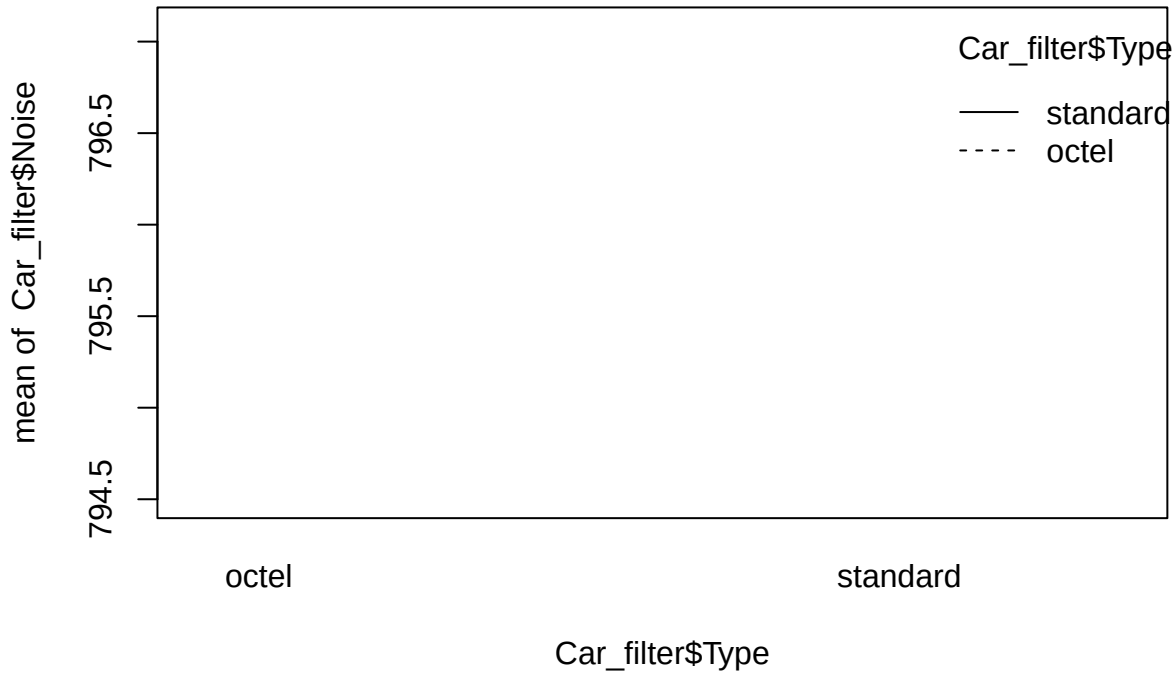
H_0 : There is no interaction between Type and Size vs H_a : There is a significant interaction between Type and Size
Car Interaction Plot

```r
Car_filter <- read_excel("~/Desktop/STAT 301/Week 4/Car filter.xlsx")
model2 <- aov(Noise~Size+Type+Size*Type, data=Car_filter)
summary(model2)
```

```
##             Df Sum Sq Mean Sq F value   Pr(>F)
## Size         1    145     145   0.327    0.574
## Type         1     40      40   0.090    0.767
```

```
## Size:Type    1  13490   13490  30.421 2.13e-05 ***
## Residuals   20   8869     443
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
interaction.plot(Car_filter$Type, Car_filter$Type, Car_filter$Noise)
```



f = 30.42; p-value = 0 Reject H0; There is a significant interaction between Type and Size.

standardfilter

```r
standardfilter <- Car_filter %>%
  filter(Type == "standard")
# standardfilter
```

octelfilter

```r
octelfilter <- Car_filter %>%
  filter(Type == "octel")
# octelfilter
```

Test Noise by Size

```r
t.test(Noise~Size, data = standardfilter, alternative = "two.sided")
```

```
##
##  Welch Two Sample t-test
##
## data:  Noise by Size
## t = -2.5359, df = 5.9968, p-value = 0.04434
## alternative hypothesis: true difference in means between group large and group medium is not equal to
## 95 percent confidence interval:
##  -83.513668  -1.486332
## sample estimates:
##  mean in group large mean in group medium
##             775.8333             818.3333
```

t = -2.5359; p-value = 0.04434 Reject H0; There is significant difference between medium and large among the standard filters.

$H_0 : \mu_{med} = \mu_{large}$ Test Noise by Size Again

```
t.test(Noise~Size, data = octelfilter, alternative = "two.sided")
```

```
##
##  Welch Two Sample t-test
##
## data:  Noise by Size
## t = 13.624, df = 6.4557, p-value = 5.366e-06
## alternative hypothesis: true difference in means between group large and group medium is not equal to
## 95 percent confidence interval:
##  43.09252 61.57415
## sample estimates:
##  mean in group large mean in group medium
##             820.6667             768.3333
```

t = 13.624; p-value = 5.366e-06 Reject H0; there is sig. diff. bt. medium and large among the octel filters

1. A clinician would like to study the effects of two different drugs (drug A and drug B) on systolic blood pressure (SBP) for patients. He would also like to consider the effects of gender on systolic blood pressure. He randomly chosen 4 females and assigned with drug A, 4 females with drug B, 4 males with drug A and 4 males with drug B. He measured the SBP after each patient taking the medication. Assuming all of the patients had similar baseline SBP. Test the main effects of drug and gender, and the interaction between drug and gende H_0 : There is no significant difference between drug A and B H_0 : There is no significant difference between males and females Drug Types

```
gender1 <- rep(c("Female", "Male"), each = 8)
drug <- rep(c("A", "B"), each = 4) # 4 A's and 4 B's
SBP <- c(120, 110, 100, 105, 99, 101, 102, 98, 100, 101, 100, 101, 121, 119, 103, 121)
BPdf <- data.frame(gender1, drug, SBP)
# BPdf

model3 <- aov(SBP~gender1+drug+gender1*drug, data = BPdf)
summary(model3)
```

```
##             Df Sum Sq Mean Sq F value  Pr(>F)
## gender1      1   60.1    60.1   1.575 0.23344
```

```
## drug          1   45.6    45.6   1.194 0.29589
## gender1:drug  1  588.1   588.1  15.416 0.00201 **
## Residuals    12  457.7    38.1
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```