hw6

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Data Preparation

```
# Import data sets in Linux
# m1 <- read.csv("/home/johnbjohn/Documents/git_repos/bacs-hw/hw6/pls-media1.csv")
# m2 <- read.csv("/home/johnbjohn/Documents/git_repos/bacs-hw/hw6/pls-media2.csv")
# m3 <- read.csv("/home/johnbjohn/Documents/git_repos/bacs-hw/hw6/pls-media3.csv")
# m4 <- read.csv("/home/johnbjohn/Documents/git_repos/bacs-hw/hw6/pls-media4.csv")

m1 <- read.csv("/Users/bijonsetyawan/Documents/Git/bacs-hw/hw6/pls-media1.csv")
m2 <- read.csv("/Users/bijonsetyawan/Documents/Git/bacs-hw/hw6/pls-media2.csv")
m3 <- read.csv("/Users/bijonsetyawan/Documents/Git/bacs-hw/hw6/pls-media3.csv")
m4 <- read.csv("/Users/bijonsetyawan/Documents/Git/bacs-hw/hw6/pls-media4.csv")

media <- rbind(m1,m2,m3,m4)
```

1. Let's describe and visualize the data:

a. What are the means of viewers intentions to share (INTEND.0) for each media type? (report four means)

Here is the mean of `INTEND.0` in each data set: (starting from media1 all the way to media4)

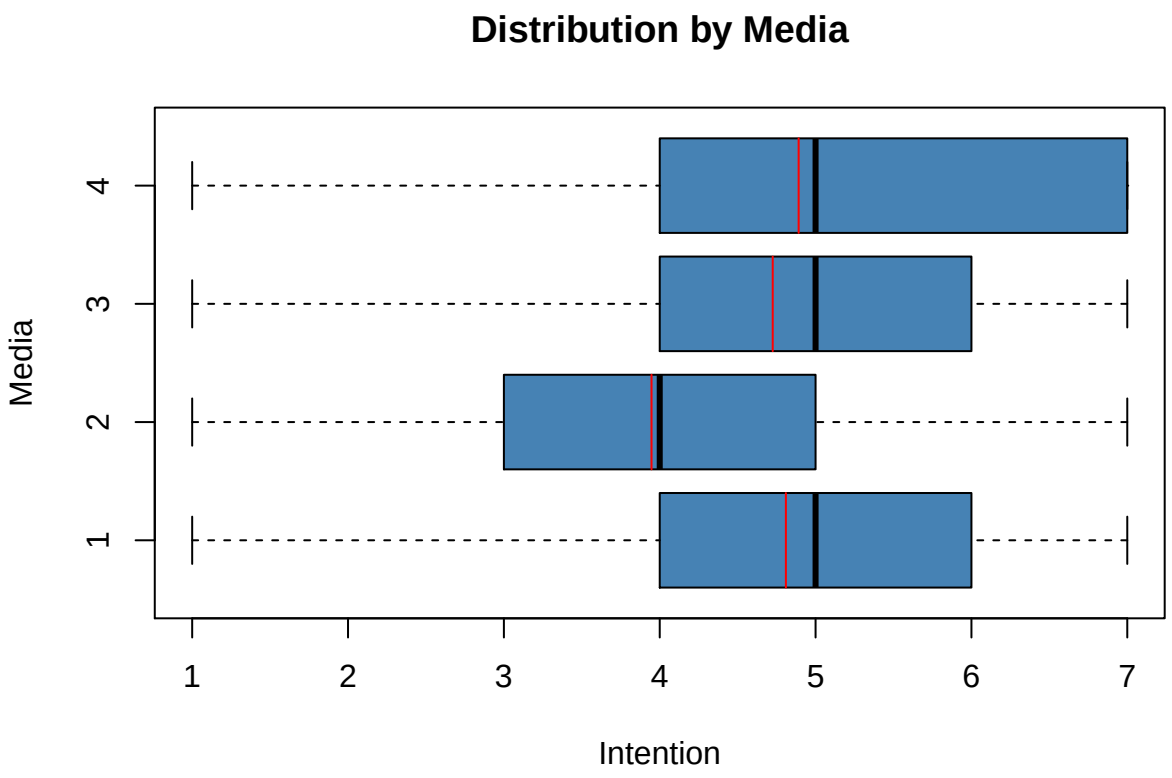
1. `media1$INTEND.0` mean: 4.8095238
2. `media2$INTEND.0` mean: 3.9473684
3. `media3$INTEND.0` mean: 4.725
4. `media4$INTEND.0` mean: 4.8913043

b. Visualize the distribution and mean of intention to share, across all four media.

```
boxplot(
  INTEND.0 ~ media,
  data=media,
  main="Distribution by Media",
  xlab="Intention",
```

```
  ylab="Media",
  col="steelblue",
  border="black",
  horizontal = TRUE
)

x0s <- 1:4 - 0.4
x1s <- 1:4 + 0.4
y0s <- c(mean(m1$INTEND.0), mean(m2$INTEND.0), mean(m3$INTEND.0), mean(m4$INTEND.0))
segments(x0=y0s, y0=x0s, y1=x1s, col = "red")
```



c. From the visualization alone, do you feel that media type makes a difference on intention to share?

In my opinion, the media won't affect the difference on intention to share since the `grand_mean` value is 4.6144578.

2. Let's try traditional one-way ANOVA:

a. State the null and alternative hypotheses when comparing INTEND.0 across four groups in ANOVA

Null hypothesis is the means of INTEND.0 in the four data sets are similar to each other. While the **Alternative hypothesis** is the means of INTEND.0 in the four data sets are not similar to each other.

b. Produce the traditional F-statistic for our test

```
grand_mean <- mean(media$INTEND.0)

intend0 <- tibble(
  media = c(1,2,3,4),
  instances = c(
    nrow(m1),
    nrow(m2),
    nrow(m3),
    nrow(m4)
  ),
  group_mean = c(
    mean(m1$INTEND.0),
    mean(m2$INTEND.0),
    mean(m3$INTEND.0),
    mean(m4$INTEND.0)
  ),
  var = c(
    var(m1$INTEND.0),
    var(m2$INTEND.0),
    var(m3$INTEND.0),
    var(m4$INTEND.0)
  ),
  sstr = c(
    nrow(m1) * (mean(m1$INTEND.0) - grand_mean)^2,
    nrow(m2) * (mean(m2$INTEND.0) - grand_mean)^2,
    nrow(m3) * (mean(m3$INTEND.0) - grand_mean)^2,
    nrow(m4) * (mean(m4$INTEND.0) - grand_mean)^2
  ),
  sse = c(
    (nrow(m1) - 1) * sd(m1$INTEND.0)^2,
    (nrow(m2) - 1) * sd(m2$INTEND.0)^2,
    (nrow(m3) - 1) * sd(m3$INTEND.0)^2,
    (nrow(m4) - 1) * sd(m4$INTEND.0)^2
  ),
)

intend0
```

```
## # A tibble: 4 x 6
##   media instances group_mean   var   sstr   sse
##   <dbl>     <int>      <dbl> <dbl>  <dbl> <dbl>
## 1     1        42       4.81  2.69  1.60  110.
## 2     2        38       3.95  2.32 16.9    85.9
## 3     3        40       4.72  3.08  0.489 120.
## 4     4        46       4.89  3.30  3.53  148.
```

```
n <- 4
sstr <- sum(intend0$sstr)
mstr <- sstr/(n-1)
sse <- sum(intend0$sse)
```

```
mse <- sse/(nrow(media) - n)
f <- mstr / mse
```

The F-statistics value is 2.6166687.

c. What are the cut-off values of F for 95% and 99% confidence according the the null distribution of F?

The cut-off value of F for 95% is 2.6593838, and the cut-off value of F for 99% is 3.9025235.

d. According to the traditional ANOVA, do the four types of media produce the same mean intention to share, at 95% confidence? How about at 99% confidence?

From the (b) and (c), we can see that the f-value doesn't go across 95% and 99% cutoff values, we shouldn't reject the null hypothesis. In the other words, we can say that each media has the same mean value.

e. Do you feel the classic requirements of one-way ANOVA are met?

Here are the requirements of one-way ANOVA:

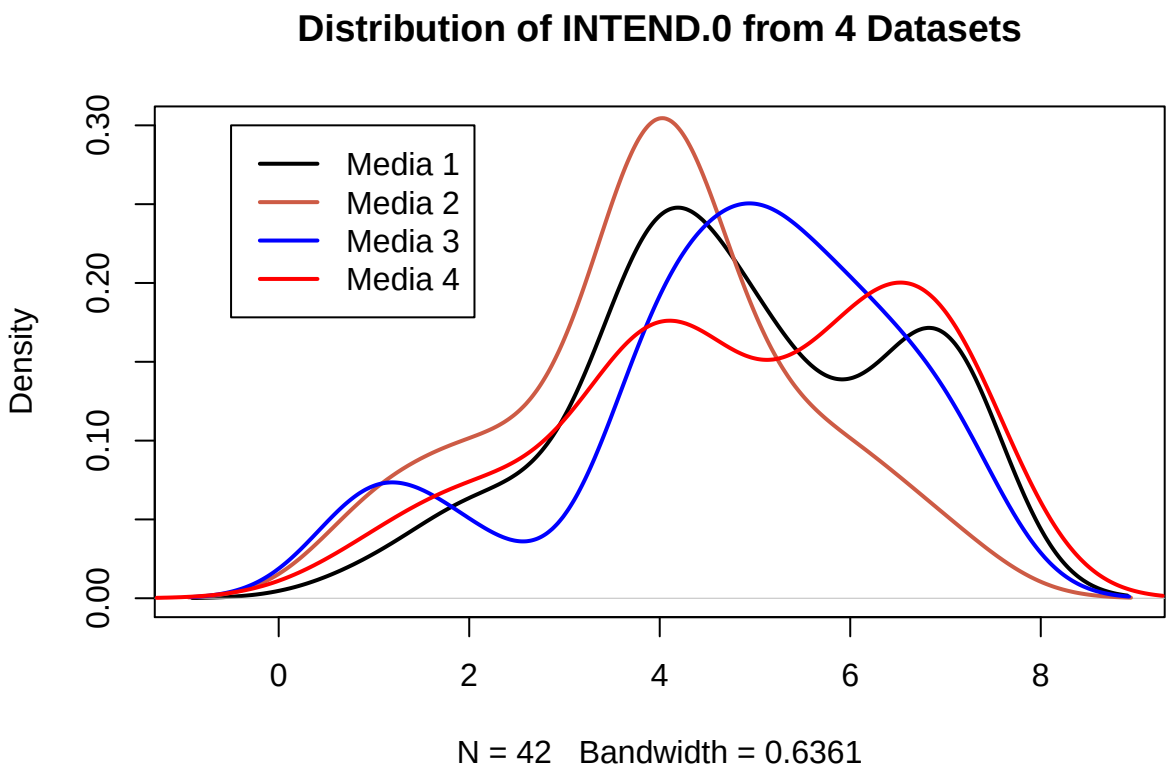
1. Variance Equality – That the variance of data in the different groups should be the same.
2. Normality – That each sample is taken from a normally distributed population.

```
intend0$var
```

```
## [1] 2.694541 2.321479 3.076282 3.299034
```

First, we can see above that, the variance from each data set quite differs from each other.

```
plot(
  density(m1$INTEND.0),
  lwd = 2,
  col = "black",
  ylim = c(0, 0.30),
  main = "Distribution of INTEND.0 from 4 Datasets"
)
lines(density(m2$INTEND.0), lwd = 2, col = "coral3")
lines(density(m3$INTEND.0), lwd = 2, col = "blue")
lines(density(m4$INTEND.0), lwd = 2, col = "red")
legend(
  -0.5,
  0.30,
  c("Media 1", "Media 2", "Media 3", "Media 4"),
  lwd = c(2,2,2,2),
  lty = c("solid", "solid", "solid", "solid"),
  col = c("black", "coral3", "blue", "red")
)
```



Second, from the graphs above, clearly the data sets are normally distributed. Thus, the classic requirements of one-way ANOVA are not met.

3. Let's try bootstrapping ANOVA

a. Bootstrap the null values of F and also the alternative values of the F-statistic.

```
boot_anova <- function(t1, t2, t3, t4, treat_nums) {
  null_sample <- c(
    sample(t1 - mean(t1), length(t1), replace = TRUE),
    sample(t2 - mean(t2), length(t2), replace = TRUE),
    sample(t3 - mean(t3), length(t3), replace = TRUE),
    sample(t4 - mean(t4), length(t4), replace = TRUE)
  )

  alt_sample <- c(
    sample(t1, length(t1), replace = TRUE),
    sample(t2, length(t2), replace = TRUE),
    sample(t3, length(t3), replace = TRUE),
    sample(t4, length(t4), replace = TRUE)
  )

  c(
    oneway.test(null_sample ~ treat_nums, var.equal = TRUE)$statistic,
    oneway.test(alt_sample ~ treat_nums, var.equal = TRUE)$statistic
  )
}
```

```
f_values <- replicate(5000, boot_anova(m1$INTEND.0, m2$INTEND.0, m3$INTEND.0, m4$INTEND.0, media$media))

f_nulls <- f_values[1,]
f_alts <- f_values[2,]
```

b. From the bootstrapped null values of F, What are the cutoff values for 95% and 99% confidence?

```
quantile(f_nulls, 0.95)
```

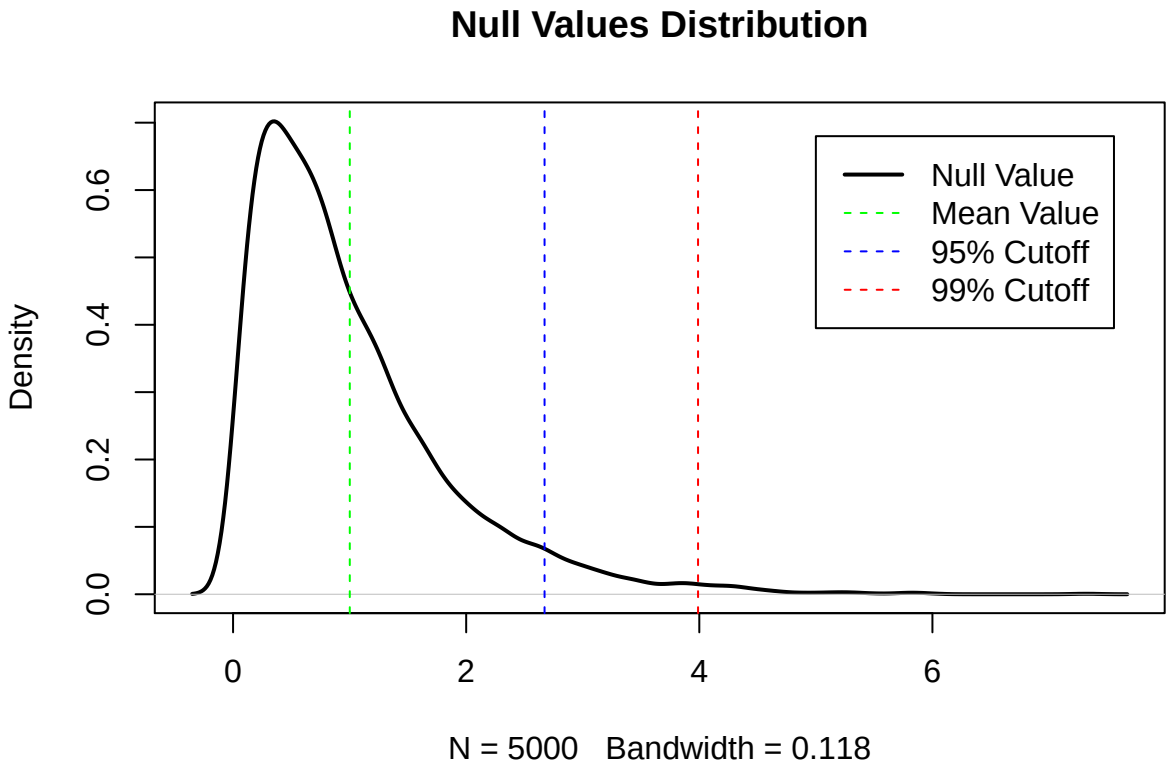
```
##      95%
## 2.672342
```

```
quantile(f_nulls, 0.99)
```

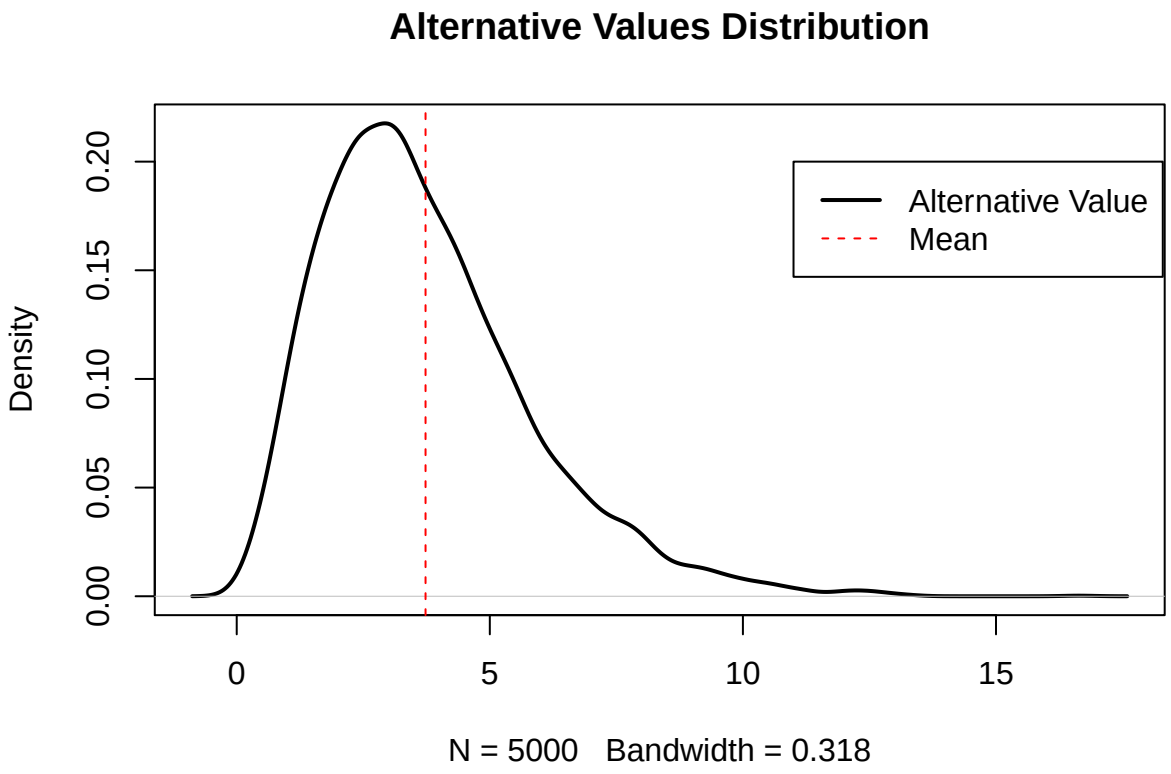
```
##      99%
## 3.989144
```

c. Visualize the distribution of bootstrapped null values of F, the 95% and 99% cutoff values of F, and also the original F-value from bootstrapped alternative values.

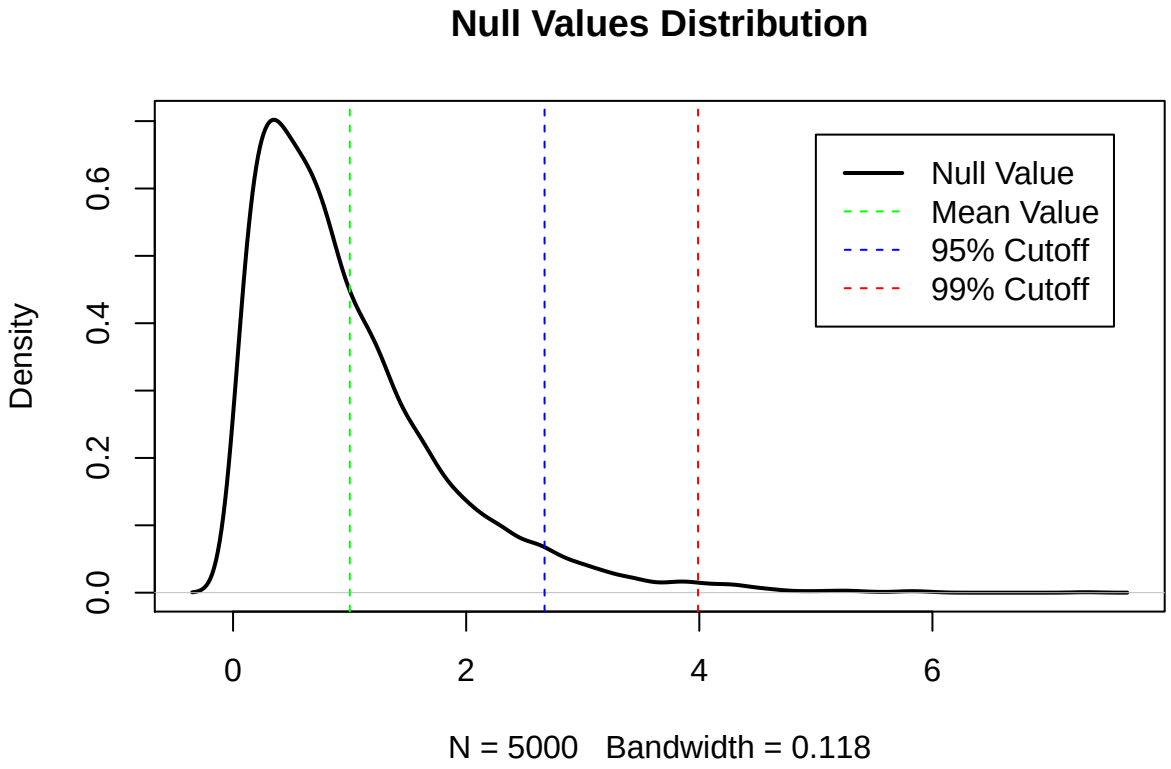
```
plot(
  density(f_nulls),
  col = "black",
  lwd = 2,
  main = "Null Values Distribution"
)
abline(v = quantile(f_nulls, 0.95), col="blue", lty = "dashed")
abline(v = quantile(f_nulls, 0.99), col="red",lty = "dashed")
abline(v = mean(f_nulls), col = "green", lty = "dashed")
legend(
  5,
  0.68,
  c("Null Value ", "Mean Value", "95% Cutoff", "99% Cutoff"),
  lwd = c(2,1,1,1),
  lty = c("solid", "dashed", "dashed", "dashed"),
  col = c("black", "green", "blue", "red")
)
```




```
plot(
  density(f_alts),
  col = "black",
  lwd = 2,
  main = "Alternative Values Distribution"
)
abline(v = mean(f_alts), col="red", lty = "dashed")
legend(
  11,
  0.20,
  c("Alternative Value", "Mean"),
  lwd = c(2,1),
  lty = c("solid", "dashed"),
  col = c("black", "red")
)
```



d. According to the bootstrap, do the four types of media produce the same mean intention to share. at 95% confidence and at 99% confidence?



Since the graph above shows that the mean of null distribution is way behind the 95% cutoff value, let alone

99%. Thus we can say that these 4 medias produce the same mean intention to share.